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AN
E S S A Y
ON
FIELD FORTIFICATION;

Intended principally for the Use of

OFFICERS of INFANTRY.

SHEWING 12 88

How to trace out on the Ground, and construct in the
easiest Manner, all Sorts of Redouts, and other Field
Works ;

ALSO,

To put into a proper State of Defense, Posts of different
kinds, such as Churches, Church-yards, old Castles,
Villages, small and large Towns, &c.

WITH FORTY COPPER-PLATES.

Translated from the original Manuscript of an Officer of
Experience in the PRUSSIAN Service,

By J. C. PLEYDELL, K

Lieutenant in the Twelfth Regiment of Foot.

L O N D O N,

Printed for J. NOURSE, Bookseller to His MAJESTY.

MDCCCLXVIII.

24



TO THE MOST NOBLE

J O H N,

MARQUIS OF GRANBY,

COMMANDER IN CHIEF OF HIS MAJESTY'S FORCES,
MASTER GENERAL OF THE ORDNANCE,
&c. &c. &c.

MY LORD,

THE following Essay, tho' chiefly
designed for the use of Officers
of Infantry, is nevertheless so calculat-
ed, as to render it instructive to the ar-
my in general. It is the result of ex-
perience, and agreeable to what was
practised during the late war in Ger-
many, where the British troops, under
Your LORDSHIP's command, served
with such distinguished reputation.

A 2

Your

iv DEDICATION.

Your LORDSHIP being now at the head of both the military departments of this country, the army, and the ordnance, and your known readiness to countenance whatever may promote useful knowledge in the service, make me presume to address this little work to Your LORDSHIP, having the honour to be with the greatest respect,

MY LORD,

YOUR LORDSHIP'S

MOST OBLIGED AND

OBEDIENT HUMBLE SERVANT

J. C. PLEYDELL.

P R E F A C E.

IF we allow that it is not absolutely necessary for an officer of infantry to have the most perfect knowledge of every different branch of Fortification, it must at the same time be confessed, that he ought to spare no pains to inform himself well of such particulars, at least, as immediately concern the strengthening, or securing, of posts, the defense of which may, in the course of service, be entrusted to his care.

For this reason he should be able, without the assistance of an engineer,

to trace out, and construct, all sorts of redouts, field-forts, tetes-de-pont, and other works ; to put into a proper state of defense churches, church-yards, old castles, villages, small and large towns, &c. so that the enemy, who intended to attack him, should be obliged to employ a much superior force, and even to lose a considerable number of men, without being able to effect their design.

It is also necessary that an officer who intends fortifying a post, should know how to make use of every advantage of ground ; he will then be sensible, that each particular line, or part of a redout, always requires a direction adapted to the spot it is to be constructed on, and often to the lying of the ground near it. At the same time, he ought to be able, in some measure, to foresee

foresee on which side he is most likely to be attacked, and know what obstacles to throw in the enemy's way, to prevent their approaching with success. He should therefore be acquainted with the manner of forming an abbatis ; of laying a dam a-cross a river so as to stop its course, and cause an inundation ; how to make fougasses, or small mines, which are most advantageously constructed in front of redouts, in order to render the access more difficult ; with many other contrivances of the same nature, which will readily occur to a man of genius.

An officer who loves his profession, will study these things diligently in time of peace, to be able, on service, to practise them in the field ; he may otherwise frequently be in a situation

equally critical and embarrassing. — Should, for example, the defense of a post be entrusted to him, with orders to maintain it to the last, how very uncomfortable must he feel, if utterly ignorant how his post should be fortified: What a feeble opposition must he make to the enemy, when at a loss what measures to take: And if forced at last, as indeed he justly deserves, how greatly will his conduct be reflected on! He will naturally be accused of having failed in his duty; nor will the mortifying acknowledgement of ignorance, be considered as any excuse. The duty of an officer to his sovereign, attachment to his profession, love of his country; his own safety, with that of those intrusted to his care; honour, a thousand times more dear than life; and, in short, the truth

truth of that maxim which so many examples have verified, *That an hundred men properly posted, and entrenched according to rule, can effect more than a thousand, who have taken up a wrong position:* — these considerations prove how absolutely necessary it is for officers to have a thorough knowledge of what is above recommended; which requiring but a slight application, and very little time, those are the less excusable who neglect any opportunity of improving themselves.

An officer should likewise accustom himself to study maps, and be conversant with plans, where the particulars are expressed more minutely.— It is not here meant, that he should be a draughtsman, or know how to take the survey of a country, and represent it
upon

upon paper; but only to understand such draughts perfectly, and be able to judge of their goodness or defects. This last piece of knowledge will give him some idea of the march of an army, with all its different movements, positions, and encampments. Even in a subaltern rank, this must be pleasing to him; but, in a higher station, is what he cannot be without. If a man wishes to serve with credit, and is sensible of his own interest, he will of course apply with the utmost assiduity in his youth, that, on proper occasions, he may shew his genius in his profession; and nothing is more to be wished for, than such opportunities.

In all military expeditions, every thing depends upon a thorough knowledge of the country: any proper measures

asures taken by a person ignorant in this essential point, must be merely accidental ; whereas they naturally occur to the man of study ; and who by application has acquired a *coup-d'oeil*. An officer who has only his courage to trust to, must be in the greatest uneasiness and concern about the success of an enterprise, or the means to baffle the enemy's designs, and even reduced to depend intirely upon the council and advice of those under his command ; while the man of true ability, in such a critical situation, and even when the case is the most desperate, finds sufficient resource in his own breast, and by the most wise and prudent steps, soon gives a very different turn to the face of affairs. It is then he reaps the fruit of all his past labours ! By taking proper measures, he cannot fail to
render

render the enemy's designs abortive, procure advantages both to his king and country, acquire reputation, gain the friendship and esteem of his superiors, the confidence and attachment of those under his command, and the approbation of every one of the profession.—Rewards, which a man of honour must prefer to all others.

The following work is sufficient to shew how very easily all this knowledge is acquired. In the first place, it is not requisite that an officer who would wish to become a field-engineer, should employ any of his time in the study of mathematics, — too dry for every one to relish. It is very certain, that many, after throwing away great part of their lives in handling the scale and compass, have yet been
unable,

unable, on service, to fortify posts as they ought to be; that is to say, they have not known how to take every advantage of the ground, and judge of its strength and defects.— Parts of knowledge most essential in an officer, and without which he can never act up to the spirit of the profession.

There is no need of problems, nor tiresome calculations, in order to learn the art of putting all kinds of posts into a proper state of defense, but only a little practice, and mechanical knowledge. I have therefore all along kept strictly up to this principle; and to avoid as much as possible being tedious, have confined myself to an exact distinction in my subjects, which, I flatter myself, will not be disagreeable to my readers; for though I am not
con-

conscious of having omitted any thing material, yet the work only consists of a few sheets. I found it, however, absolutely necessary to add a number of plates, in order to make every thing thoroughly intelligible : there are forty in all ; and should I be blamed for having so many, it can give me but little concern, as none will pretend to prove a person can explain himself too fully in a work intended to instruct. These plates may likewise be of great service to officers who wish to acquire a thorough knowledge in ground, as the most common incidents, in points of situation, are touched upon, and some of them even take in intire districts of country, with all the variety that can happen.

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AN
E S S A Y
ON
FIELD FORTIFICATION.

CHAP. I.

Of Works, and how to trace them on the ground.

SECTION I.

THERE are several kinds of field-works, such as fleches, redouts of four or more sides, star-forts, tetes-de-pont, entrenchments behind which troops encamp, &c.

It is not at all necessary that an officer, who means to trace out any of these
B works,

works, should do it mathematically, which requires both calculations, and proper instruments; there is a method much more easy, less complicated, and entirely depending upon practice. Let a cord be provided, one end set off in twenty divisions, a foot each, and the remainder in toises of ten feet; a few small pickets are likewise necessary, to mark the angles; and thus you have every thing requisite for tracing out field-works. If one is obliged to construct them in the night, a rope of straw may be made use of, as it is more easily distinguished.

SECT. II.

The best defense, in works that are flanked, or where one side is defended by the fire of another, is that formed by right-angles*; it is therefore necessary

* When one right line stands upon another, so as to make the angles on either side equal, they are called right-angles, and the upright line, the perpendicular.

FIELD-FORTIFICATION. 3

to know how to lay them down with exactness. Twelve feet of the above cord, are sufficient for this operation. Let us suppose a line AB , at the two extremities of which it is required to lay down a right-angle to the front. At the extremity A , set off three feet of the cord cd , and four feet to the front de : join ec with the remaining five feet of the cord (the end of it being fixed at c), and you have the right-angle † required. Proceed just in the same manner in laying down

Plate
I.
Fig.
1.

If the extremities of the perpendicular, and the line on which it is erected, are joined by another right line, it will form a right-angled triangle; the side opposite the right-angle being called the hypotenuse.

† The formation of a right-angle, according to this method, depends upon the 47th proposition of the first book of Euclid, where it is demonstrated, that the square of the hypotenuse, in a right-angled triangle, is equal to the sum of the squares of the other two sides. But if it should be necessary to lay down a right-angle, with very great exactness, in the field, especially where the sides are to be produced to a considerable extent; instead of 3, 4, and 5 feet, which in the author's example compose the sides of the triangle, any equi-multiples of these numbers may be substituted, viz. 6, 8, and 10; 9, 12, and 15; or 12, 16, and 20 feet, &c. which will form the right-angle required, with still greater accuracy.

B 2

right

right-angles to the opposite side of the line A B, or more properly to the rear.
 Plate 1. This method, however, is only used
 Fig. 2. when the angles must be traced exactly true; otherwise the eye is sufficient, without the help of the cord, which a little practice will soon render easy.

SECT. III.

In every kind of work that comes under the article field-work, it is of very little consequence whether the angles are exactly right, that is, of 90 degrees †, or more or less open; for the defense of such works will always be good, provided the angles are neither too acute ||, as in Plate 1. Fig. 3. nor too obtuse, as Fig. 4.

† All the angles which can possibly meet about a point, being equal to four right-angles, or to the whole circumference of a circle, which is always divided into 360 degrees; therefore a right-angle, or one-fourth part of the circumference, is equal to 90 degrees.

|| An acute-angle is that which is less than a right-one; and an obtuse-angle is greater.

SECT. IV.

SECT IV.

It is a general rule in fortification, never to make a falliant-angle * less than 60 degrees, as otherwise it would be too acute. This may be prevented by the eye alone; but when the *coup d'œil* cannot be depended on, it may be laid down according to the following method.

At the extremity of the line where the falliant-angle is to be formed, trace a right-angle $b a c$; at the point a fix a small picket, with a cord of five or six feet tyed to it; and with another picket at the other end of the cord, describe the arc $b c$ §, of 90 degrees, the measure of the right-angle. Divide the arc into three equal parts, by help of the cord, Fig. 5.

* A falliant-angle is that whose point turns from the center of the work.

§ An arc is a certain portion or number of degrees of the circumference of a circle.

marking each with a small picket *d*; by which means it is easy to avoid making the angle less than 60 degrees, as each division of the arc contains 30, and, of course, two of them, 60 degrees.

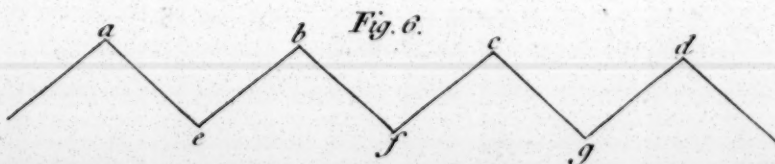
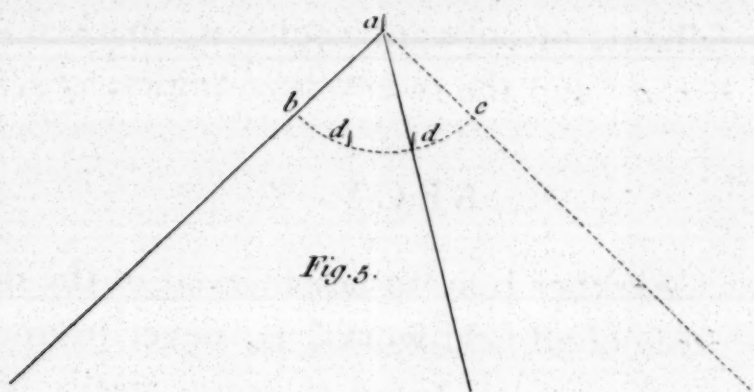
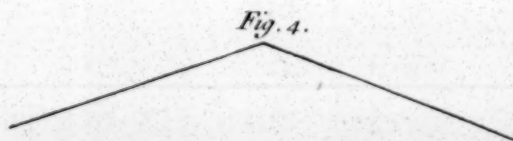
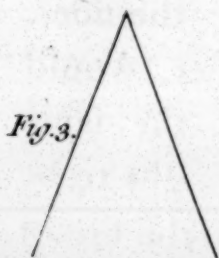
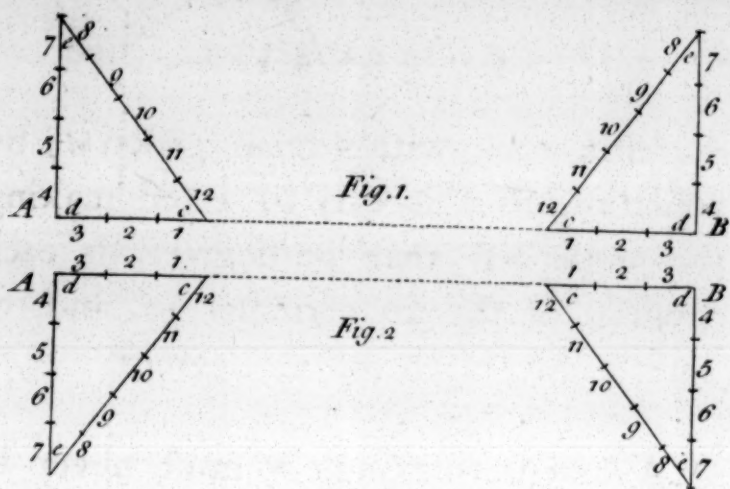
A re-entering-angle * must never be less than 90 degrees, otherwise the sides, instead of protecting each other, would do mischief by their fire; at the same time, no re-entering angle ought to be greater than 120 degrees, that the fire of the two lines may cross sufficiently. The falliant, or outward angles are marked *a*,
 Fig. 6. *b, c, d*; and the re-entering angles, *e, f, g*.

SECT. V.

Another rule to be observed in the defense of all field-works, is, never to draw up the garison more than two deep. The

* A re-entering-angle is that whose point is turned towards the center of the work.

reason



NOTATION

FIELD-FORTIFICATION. 7

reason is very obvious; for, when in three ranks, it is impossible the third can fire, without incommoding the first, who cannot kneel, as the parapet, or breast-work, is in their front. When, therefore, the dimensions of a work are to be determined, the strength of the detachment appointed for its defense, must be first known; it is then easy making a calculation, allowing an ordinary pace, or two feet, to each file, two deep. Indeed, it would be a good method, in order to construct these kind of works with expedition, to accustom one's self to such paces, which would save the trouble of measuring the lines with the cord. When cannon are intended to be placed in a work, six paces are allowed to a field-piece, and eight paces to a twelve-pounder. Proceed as follows: for example, each face of a fleche *, which

* A work of two faces, usually raised in the field, to cover the quarter guards of a camp, or advanced posts,

forty men, or twenty file, are appointed to defend, is ten paces; but if there are two pieces of cannon, each face is sixteen paces. A square redout, to contain two hundred men, or one hundred file, is twenty paces each face; and if cannon are to be put into it, as many paces are allowed to each piece, as mentioned above.

It must always be remembered, to proportion exactly the size of a work, to the number of men that are to defend it. If too large, it cannot be mann'd properly, and the enemy will make themselves masters of it with very little trouble, or loss. Indeed, it is not of so bad consequence to make it too small, as a reserve may be formed of those who have not room to act, ready upon occasion to re-

and often constructed before the glacis of a fortified place, when threatened with a siege, in order to keep the enemy as long at a distance as possible.

inforce

FIELD-FORTIFICATION. 9

inforce the part attacked. The least interior circumference that can be allowed to a square redout, is eighty paces; for if less, those who defend it would only incommode one another, and, should the enemy use grenades, must pass their time very ill.

SECT. VI.

If a work is so large as to require two, or more, battalions to defend it, a reserve must always be appointed, which properly should be the sixth part of the garison. For example, should twelve hundred men be destined for the defense of a work, it must be constructed to contain only a thousand, reserving two hundred, which are placed in the center, ready to assist, as circumstances may require,

SECT.

SECT. VII.

The following method may be used to construct a fleche to contain fixty men, or thirty file, with two pieces of cannon. When an officer arrives with his detachment where he is appointed to remain, he must divide his men into two platoons, drawn up in form of a fleche, constituting a right-angle *a*. He then stretches the cord close along their front, tracing out the line of the work, and adding six paces to each face, for the field-pieces. This line expresses the inside of the parapet *b* *, which may be only about six feet thick in small fleches, thrown up to cover

Plate
2.
Fig.
1.

* The author has constantly made use of the word rampart, which, in regular fortification, comprehends not only the parapet, or breastwork, over which the men fire, but likewise the banquette, whereon they stand, and such elevations of earth, behind both, as the cannon are placed upon; but it being seldom that a rampart is raised in the field, which requires great time, therefore, in the translation, parapet has in general been introduced instead of rampart.

the

FIELD-FORTIFICATION. 11

the quarter-guards of a camp. A line is then traced, parallel* to this first line, determining the thickness of the parapet *b c*. The berme *d*, is next marked out, by another parallel line, being only a certain portion of the level ground, left to sustain the weight of the parapet, which otherwise would be liable to tumble down. Two feet are sufficient for the breadth of the berme. The ditch is afterwards traced, six feet wide, the earth of which forms the breast-work. A line is then drawn within-side of the fleche, for the banquette *f*, four feet broad, on which the soldiers stand, when they defend the work. The banquette is made eight, or ten, feet broad, where the cannon are to be placed. When the fleche is finished, the men and guns are disposed as follows :

* Two lines, which, if infinitely produced both ways, would never meet.

Fig. 2. *a b*, Fifteen file, lining the right face.

c d, Fifteen file, lining the left face.

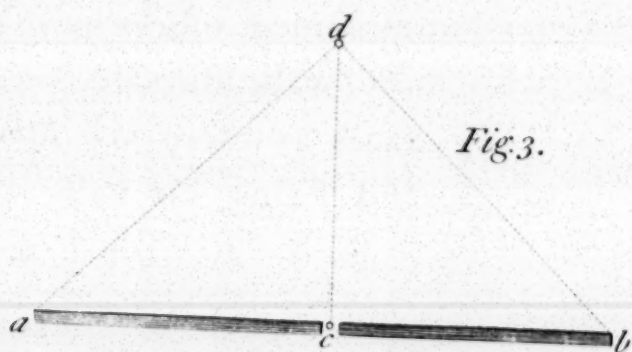
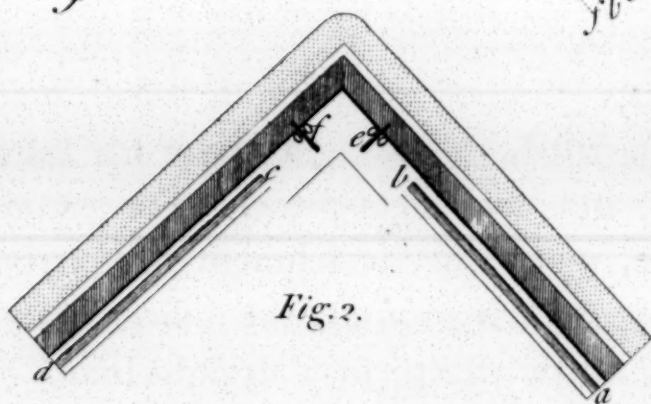
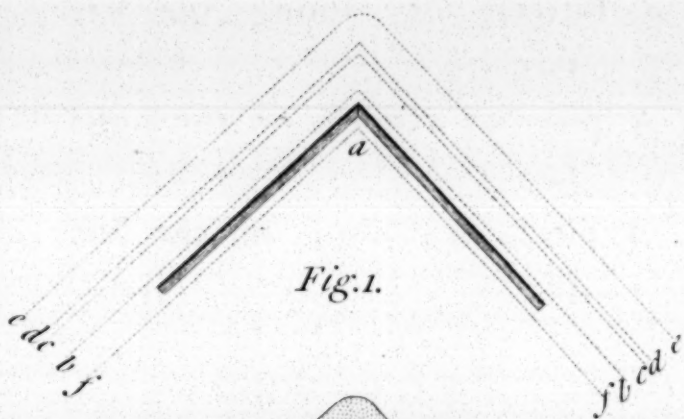
e, A piece of cannon on the right face.

f, A piece of cannon on the left face.

SECT. VIII.

There is another method, which may be practised, in tracing a fleche for sixty men, and two field-pieces. For example, when the detachment are arrived upon their ground, the officer draws them up two deep, in a straight line *a b*, dividing them into two platoons, and placing a noncommissioned officer in the center *c*, who must walk directly forward, as many paces as there are files in one platoon, and fixing his halbert,

or



FIELD-FORTIFICATION. 13

or a picket *, where he halts d , which gives the angle of the fleche. From d , trace a straight line to the right flank of the detachment b , and another to the left flank a , which forms the line of the parapet. All the other lines are traced in the same manner, as mentioned in the preceding section.

SECT. IX.

A square redout, to contain two hundred men, with two pieces of cannon, is traced as follows :

	Paces.	
For two hundred men, or one hundred file, two deep,	100	} Circumference of the rampart.
Two pieces of cannon, six paces each, — — — — —	12	
Total 112		

The hundred and twelve paces, divided Plate by four, the number of faces, gives 3 twenty-

* Pickets are stakes about three feet long, and an inch and half diameter, pointed at one end.

ty-

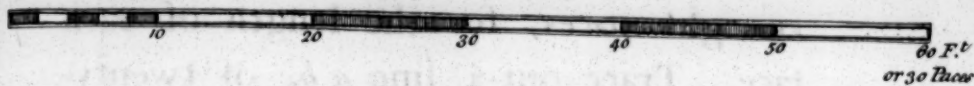
ty-eight paces, for the length of each face. Trace out a line *ab*, of twenty-eight paces, and lay down a right-angle *d* and *c* at each extremity; prolong the two lines that constitute the two right-angles, to *e* and *f*, twenty-eight paces, so that three sides are already found: join *ef*, which compleats the redout.

The entrance should be always made in the face least exposed to an attack, or enfilade *. It is five paces wide, to give room for the cannon to pass; but if none are to be put into it, three or four paces are sufficient. It is covered by a traverse *g* †, within-side the work, reaching three or four paces beyond the entrance, on

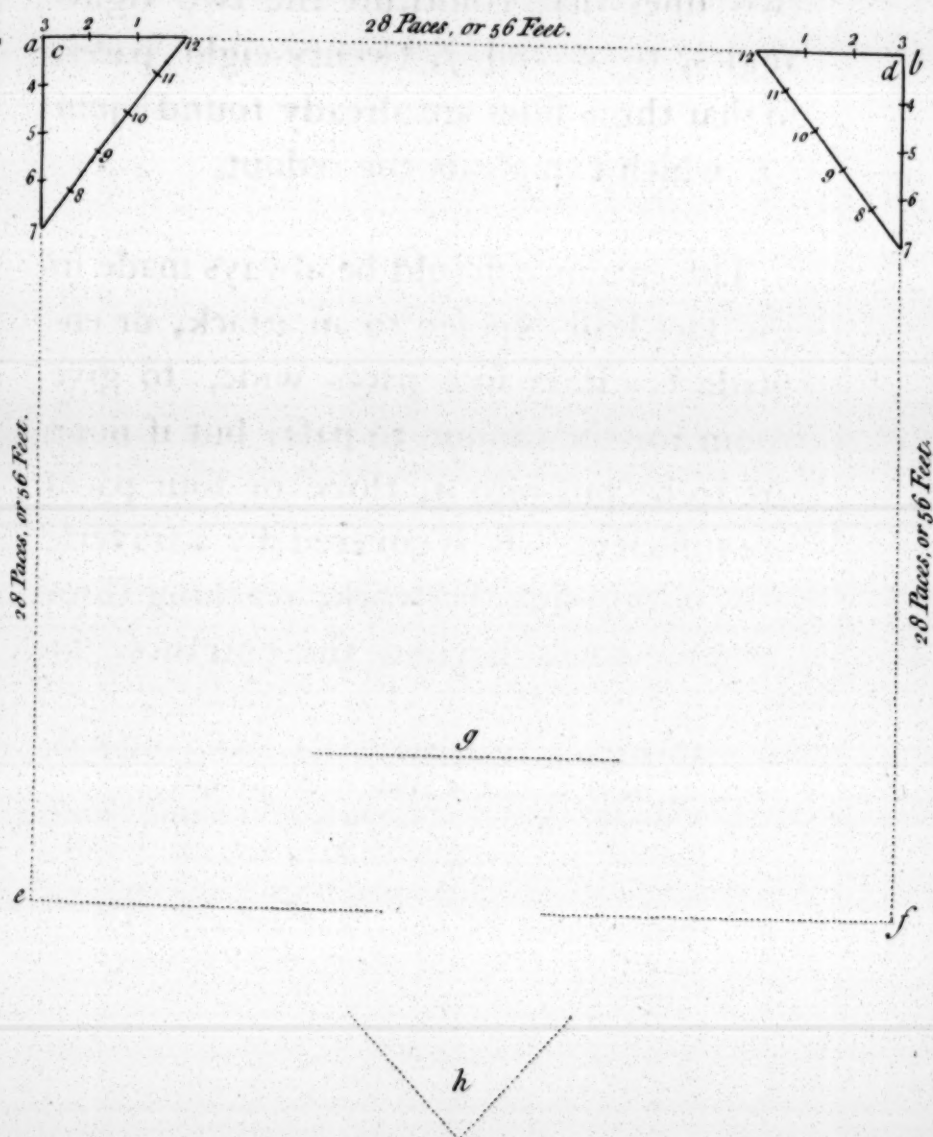
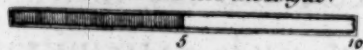
* When the guns can fire into a work, so that the shot may go all along the inside of the parapet.

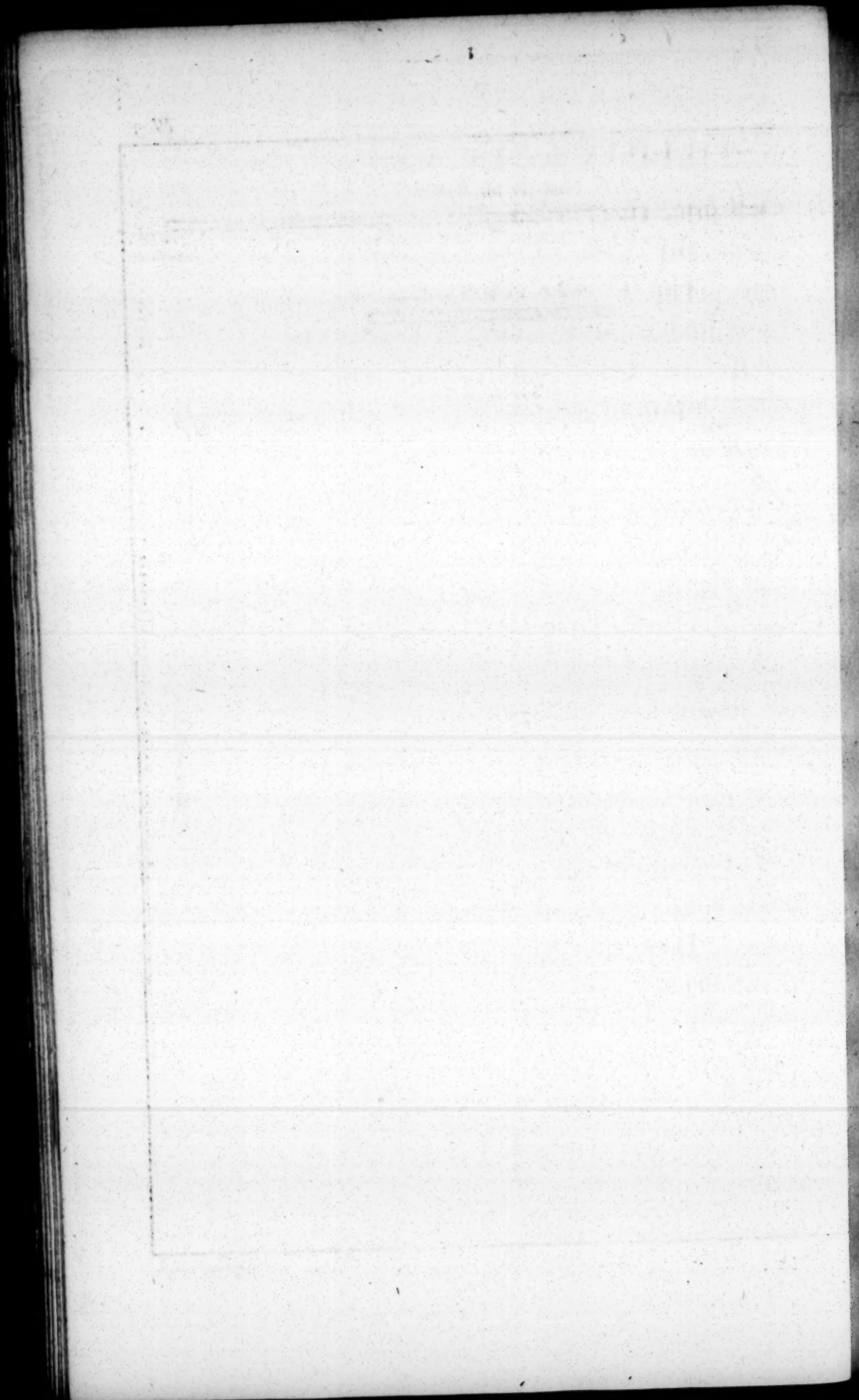
† Traverses in the covered way of a fortified place, are breast-works, generally eighteen feet thick, with a banquette, and are of the same height with the top of the glacis, constructed to prevent enfilades; but the small traverses to cover the entrances of redouts in the field, need not be above eight feet thick.

Scale for the Redout



Scale to construct the Angles.





FIELD-FORTIFICATION. 15

each side, that the enemy may not discover any part of the garison in the rear. The ditch of the traverse ought to be at such a distance from the entrance, as not to obstruct the passage, especially when cannon are to be taken into the work.

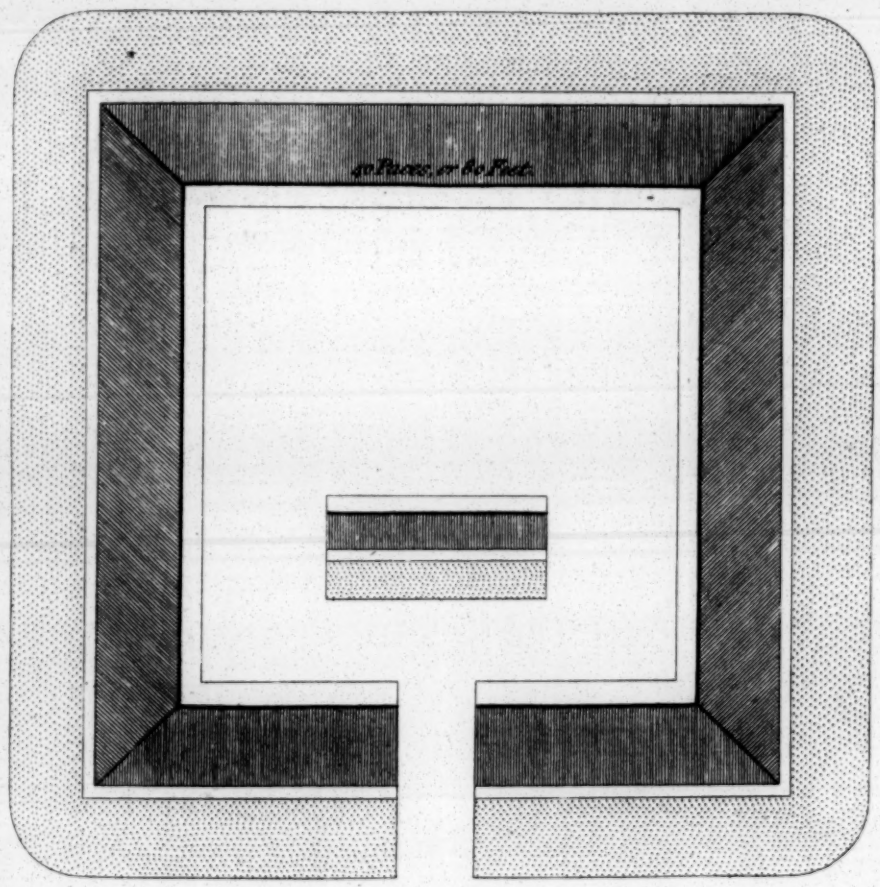
The entrance may be also covered on the out-side, by a fleche *b*, which, however, is but seldom done, except when a redout is very large: In that case, great care must be taken, that the ditch of the fleche is defended by the fire of the work.

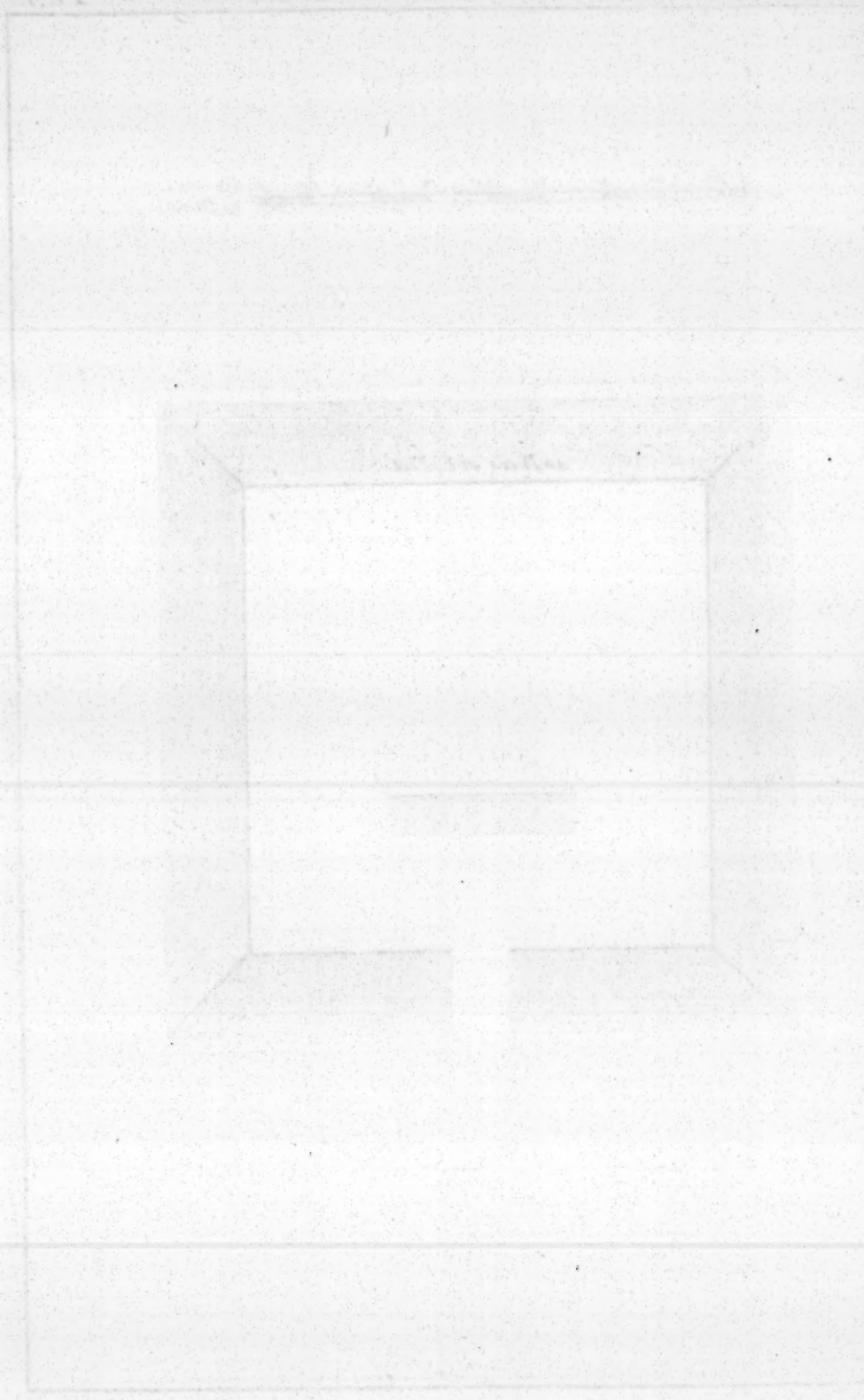
SECT. X.

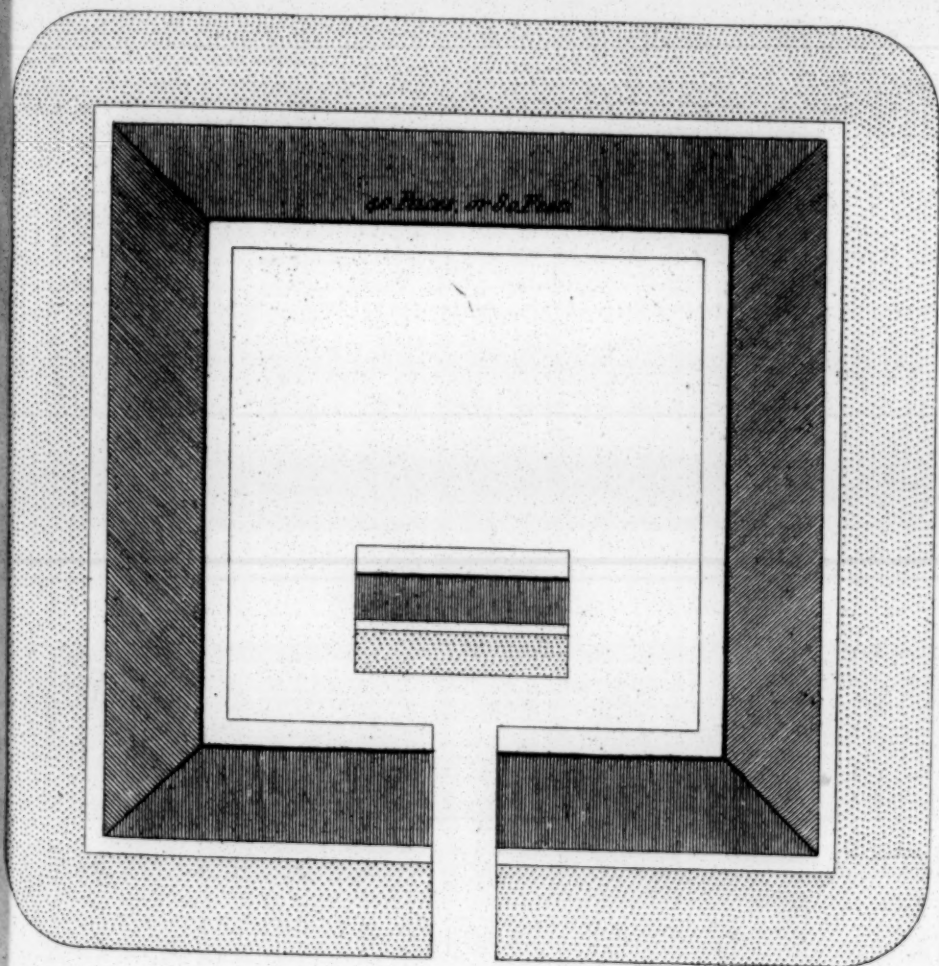
The parapet of a redout must be thicker, and the ditch both broader, and deeper, than they are generally made in small fleches, thrown up in front of a camp, to cover the quarter-guards, &c. otherwise they will soon be destroyed by
the

the enemy's cannon. It should therefore be known, that a ball from three to six pounds weight, will enter three or four feet into earth newly cast up; and a twelve-pounder, eight feet. This, at once, determines the thickness of the breast-work: and, indeed, in order to resist cannon shot, it ought never to be made less than twelve feet. It is sometimes made even fourteen feet thick, when the post is of great consequence. In a clay soil, the berme is two feet broad, but three when of a loose sandy nature. The ditch is generally made as wide as the parapet is thick: when the latter is twelve feet, the breadth of the ditch is the same. The banquette is four feet. All this is very fully explained in the plates. In number IV. the parapet is twelve feet, the ditch twelve, the berme two, and the banquette four; and in number V. the parapet is fourteen feet.
the

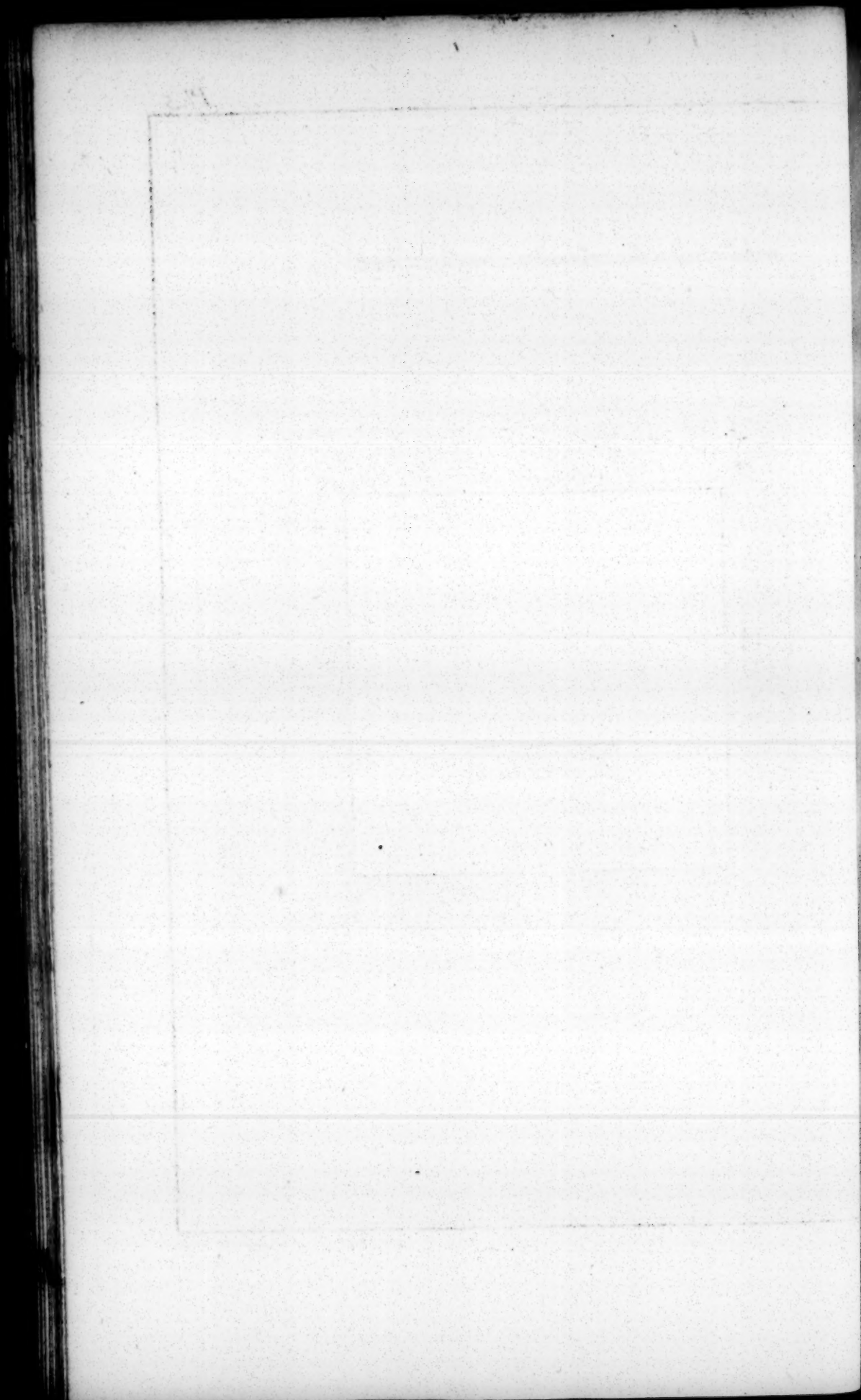
Plate
4 & 5,







T. Jefferys sculp.



FIELD-FORTIFICATION. 17

the ditch fourteen, the berme three, and the banquette four.

SECT. XI.

As the above proportion between the parapet and ditch, cannot be exactly followed, except when the former is six feet high, and the latter six feet deep, some other proportion ought to be found by calculation; but as that is more the business of a mathematician than an officer, the above dimensions may be very safely adhered to.

SECT. XII.

The ditch should never be made less than six feet deep; but when either stones or springs prevent digging, the breadth must be increased, in order to have earth enough for the parapet. With regard to the traverse, or fleche, which covers the entrance of a redout, its parapet

C

need

need only be made about eight feet thick, and the ditch eight feet broad.

SECT. XIII.

As the faces of square redouts have only their own fire to trust to, not being defended by any other part, this inconvenience ought to be in some measure obviated, by placing them so, as to procure some advantage from their situation, that is, by constructing them on heights, or having one, or more sides, covered by a river, morafs, ravine *, valley, &c. or strengthening them with abbatis †, che-

* Ravine, or deep hollow, usually formed by a great flood, or long continued running of water.

† Abbatis are formed by cutting down many intire trees, whereof the branches are turned towards the enemy, and, as much as possible, entangled one into another. They are made either before redouts, or other works, to render the attack difficult, or sometimes along the skirt of a wood, to prevent the enemy from getting possession of it. In this case, the trunks serve as a breast-work, behind which the troops are posted, and for that

vaux-

FIELD-FORTIFICATION. 19

vaux-de-frise †, trous-de-loup §, fougasses ||, &c.

SECT. XIV.

The chief care in tracing out a redout, should be, to examine thoroughly which is the quarter the most exposed, or where the enemy can the easiest approach. As an angle is always the weakest part of every work, it of course ought not to be presented to that side, but, on the contrary, one of the faces ought constantly to be opposed to it. For example, the

reason should be disposed so as that the parts may, if possible, flank each other.

† Chevaux-de-frise consist of a long beam, commonly square, but sometimes pentagonal, or even hexagonal, into which are inserted flat fraises, or pieces of wood, only pointed, if made in a hurry in the field, but shod with iron, if prepared beforehand, and deposited in arsenals. See their uses in Chap. II. Section 7th.

§ Trous-de-loup, round holes six feet deep, and pointed at bottom, with a stake placed in the middle.

|| Fougasses, or small mines. See their construction, Chap. IX.

Plate face ab , commands the defilè c , towards
 6. which the enemy might advance by the
 Plate two roads d and e . The face fg , defends
 7. the ravine b , on the left; and the face
 gi , that on the right, h .

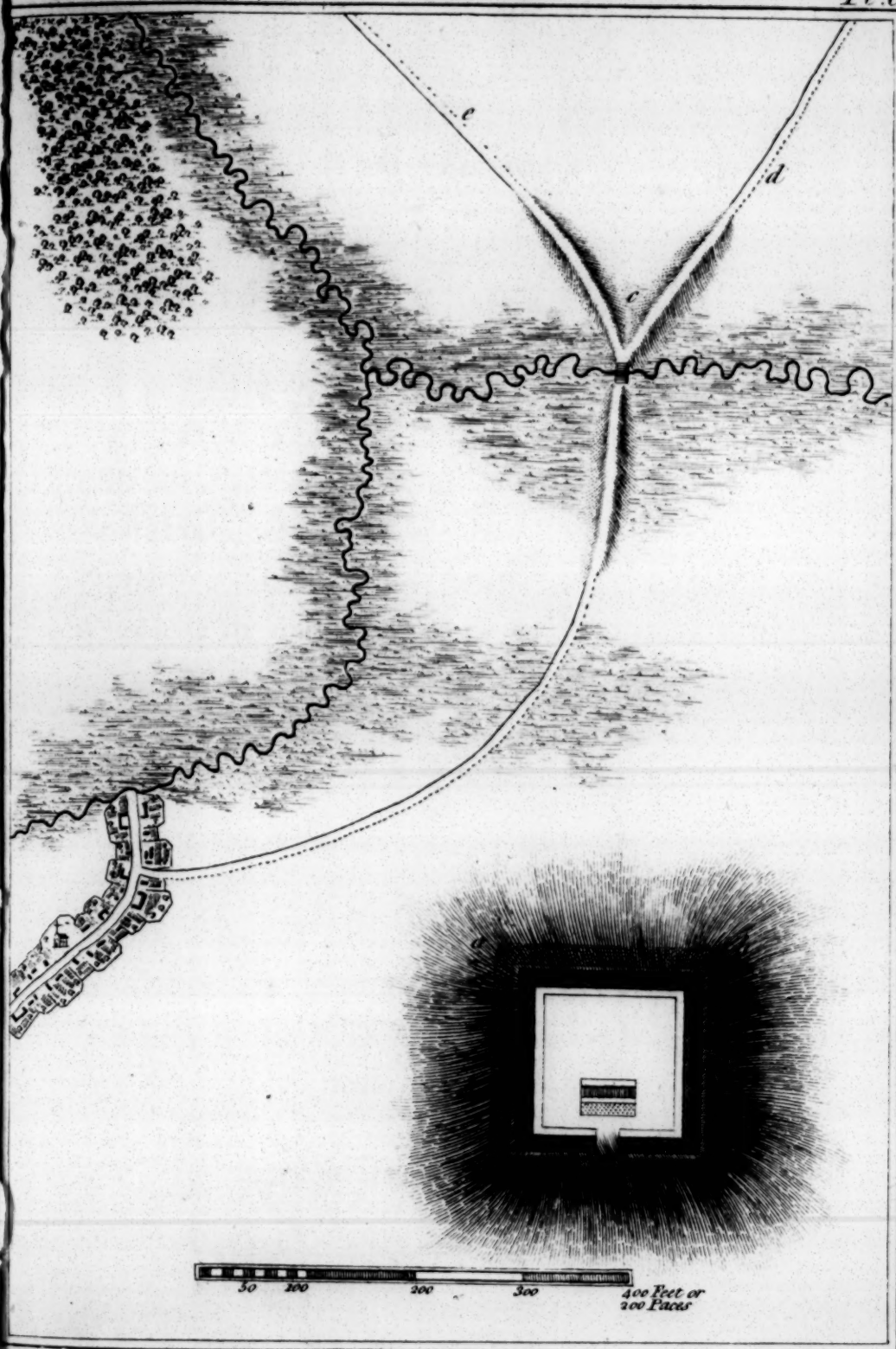
Works thrown up to defend the passage of a defilè, must be always within musket-shot, otherwise the time employed in constructing them, will be intirely lost; for the enemy will pass in the very face of the garison.

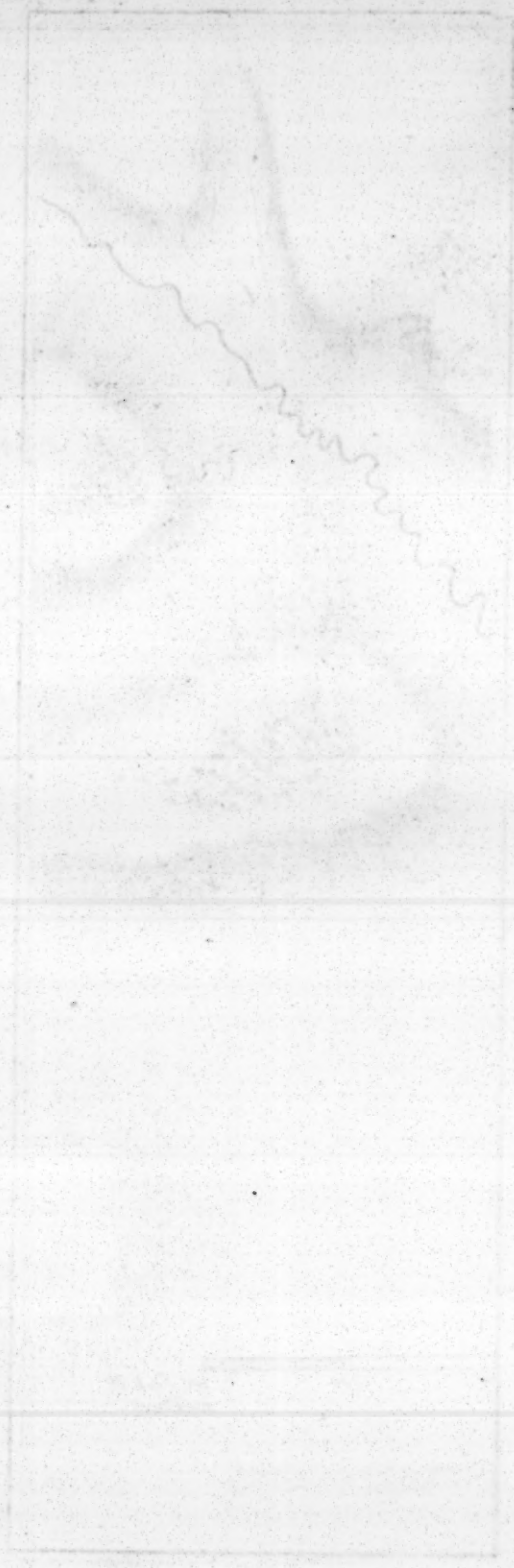
SECT. XV.

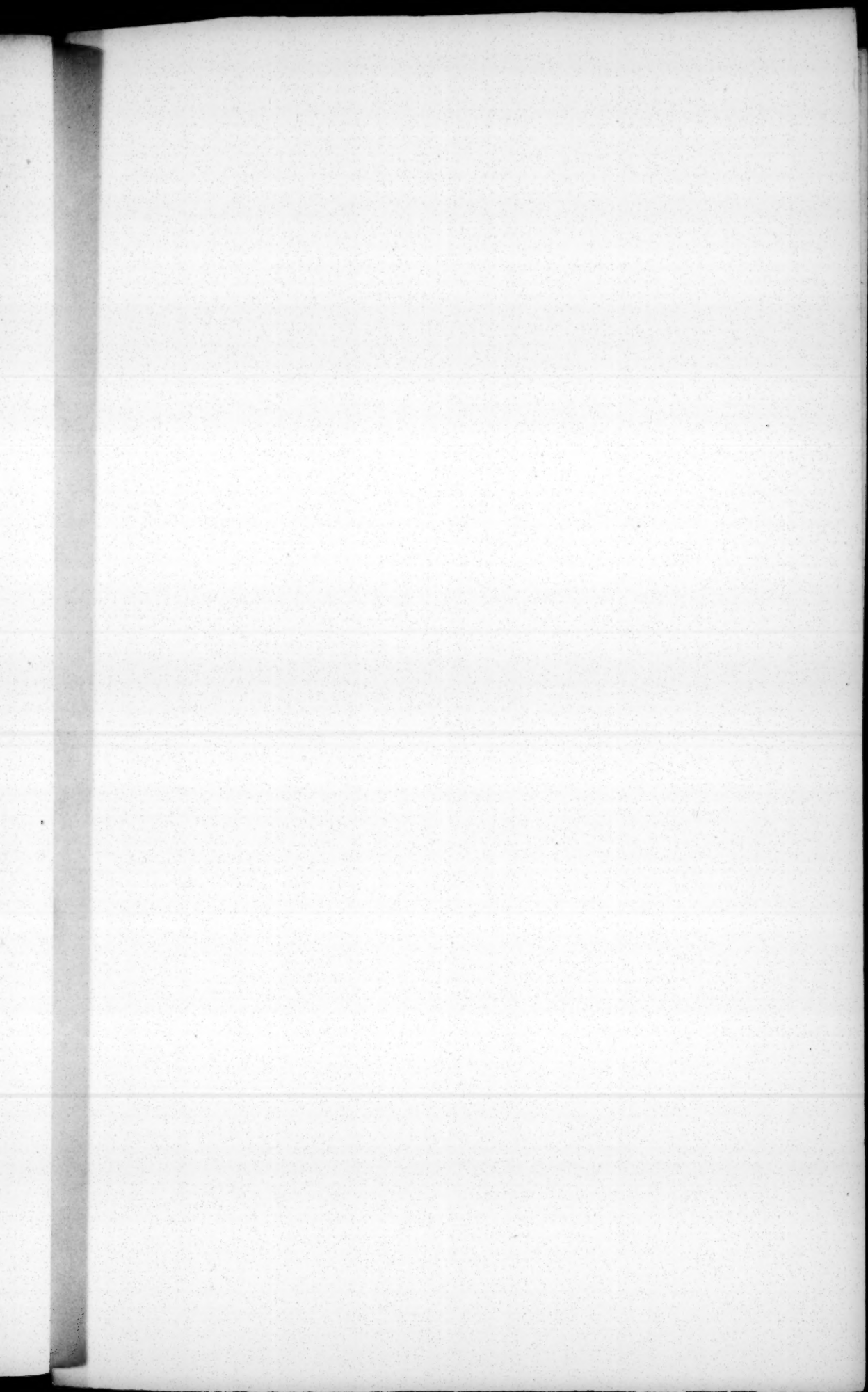
It is not at all necessary, redouts should
 be traced exactly square, except in the
 Plate construction of star-forts: they are full as
 8. serviceable made in form of a rhomb *, a ,
 Fig. 1. or with one side longer than another, b .
 2. This method, so far from being defective,

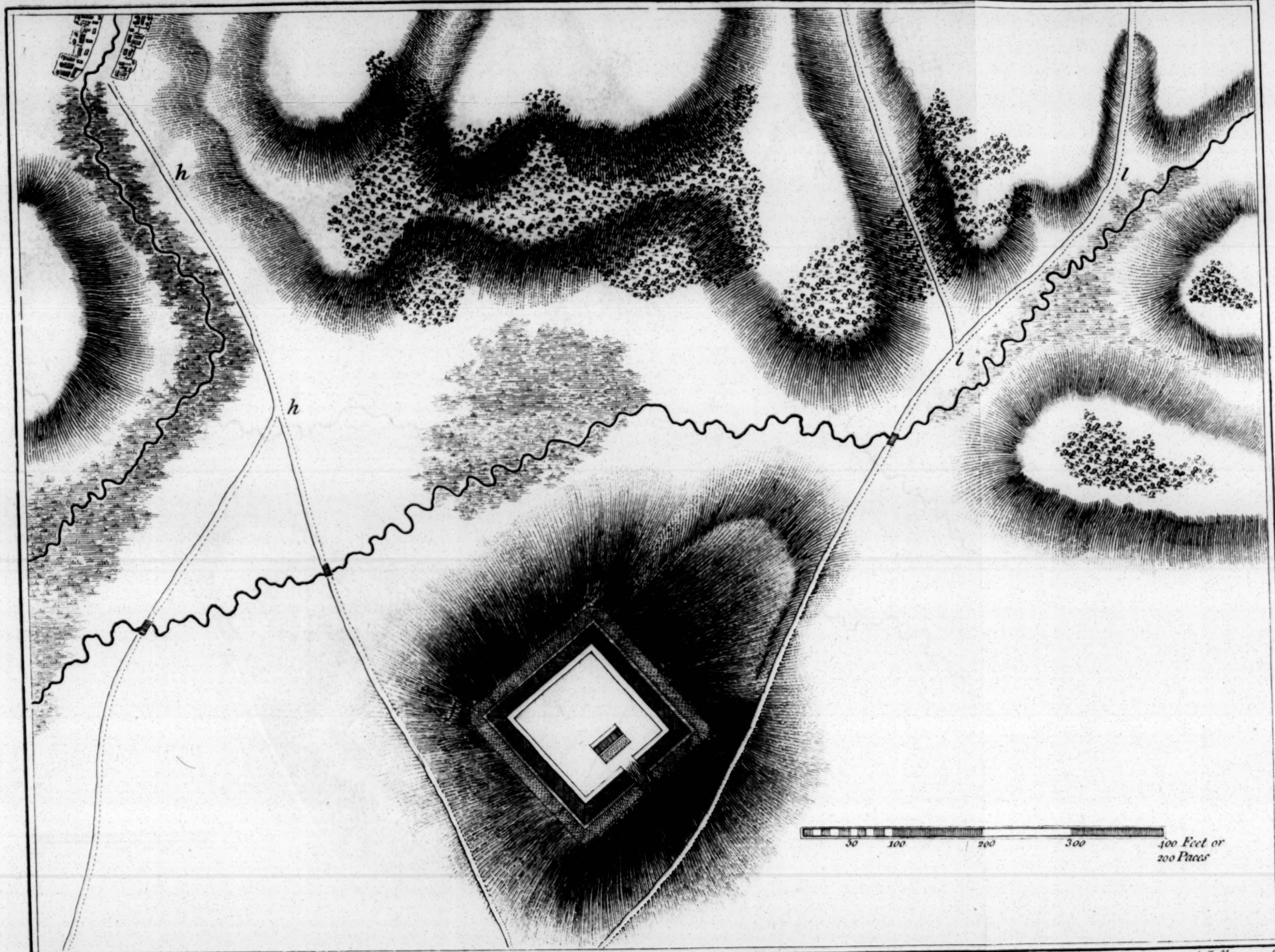
* Rhomb is a figure which has four equal sides, but whose opposite angles, only, are equal to each other.

becomes

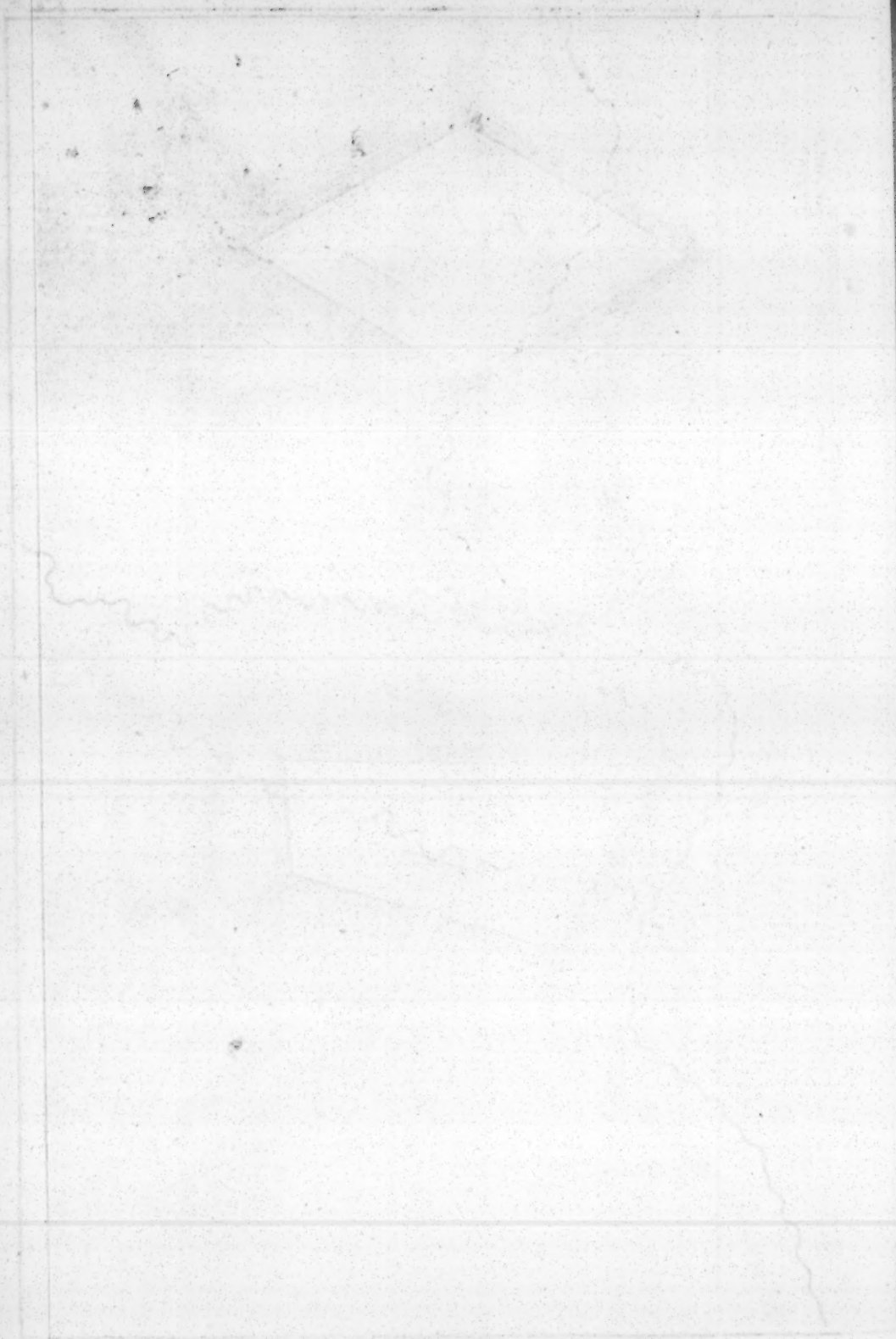




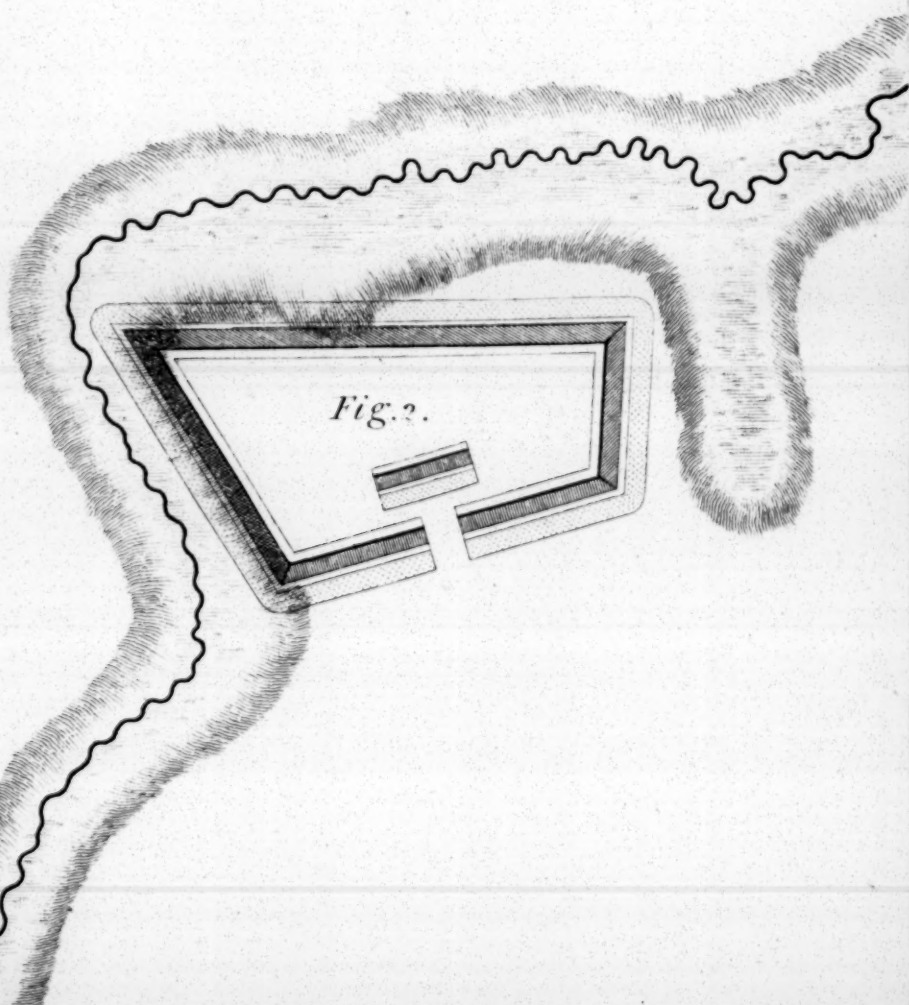
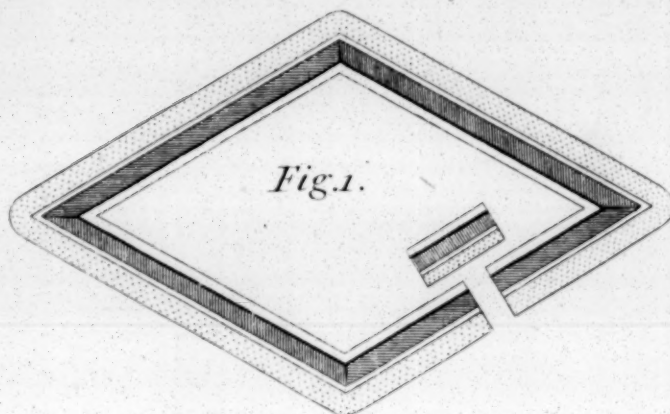


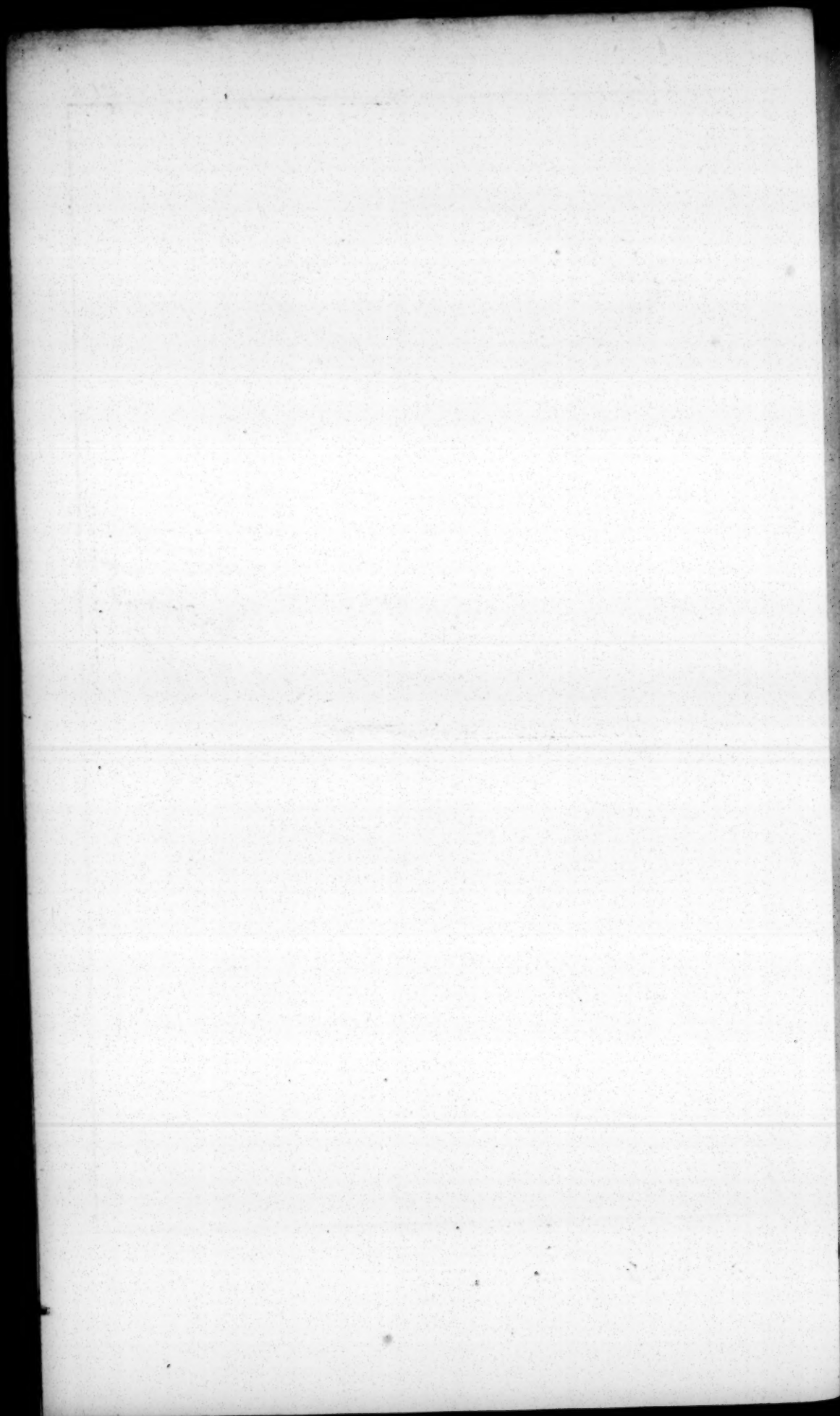


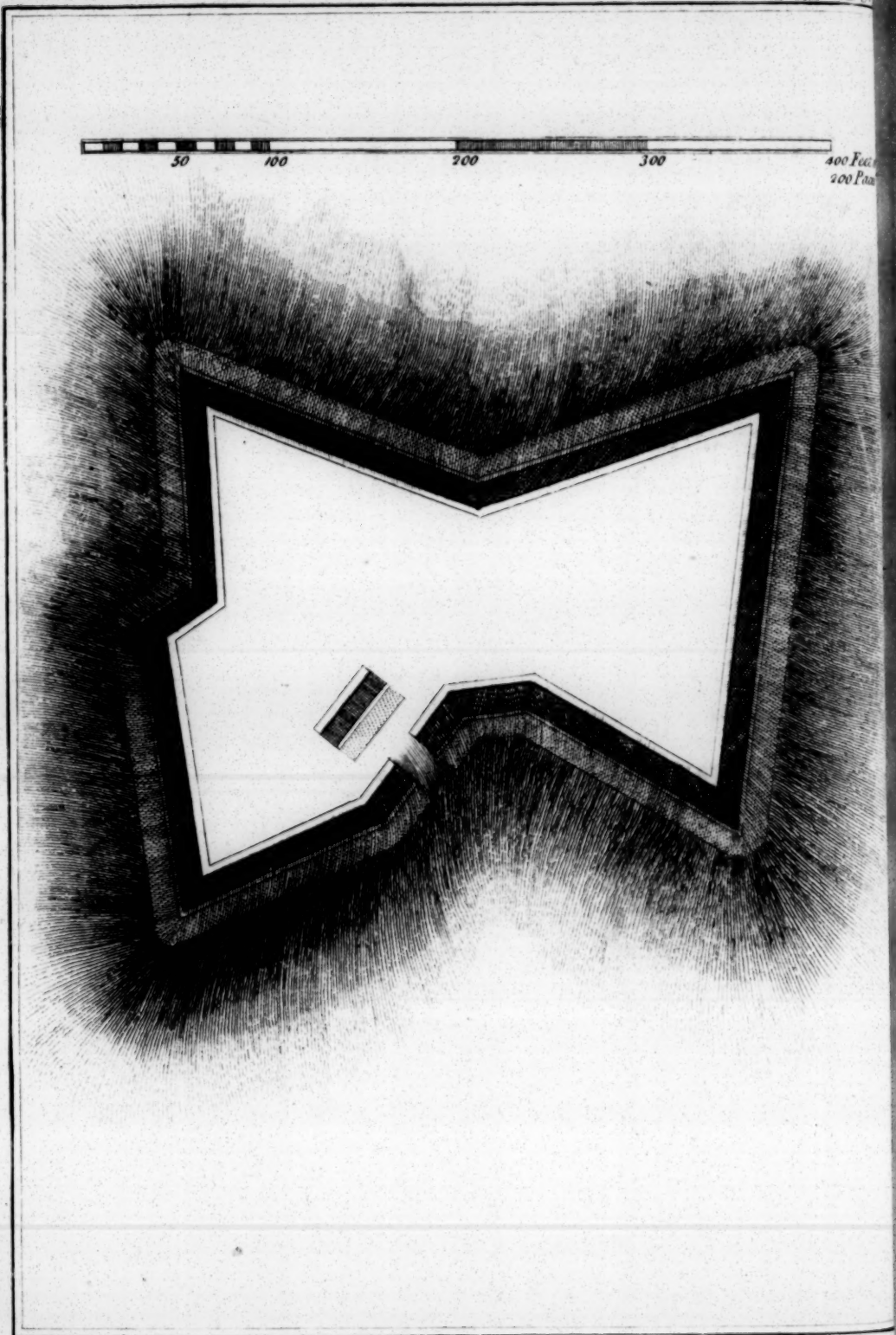
50 100 200 300 400 Feet or 200 Paces



100 Feet or
200 paces







FIELD-FORTIFICATION. 21

becomes absolutely necessary, when the ground neither allows, nor indeed requires, works to be exactly regular. Generally speaking, it is the spot they are to be constructed on, as well as the lying of the ground near them, which should determine their figure. Let us suppose, for example, a height is to be occupied by a work; every line must be so disposed, that the slope of the hill all around, even to the very bottom, must be intirely open to the garison's small-arms, or, at least, every thing discovered within five hundred paces. When such an advantage can be gained, it is very immaterial whether the redout has four, or more, sides; ^{Plate 9.} it is only requisite, to be able to defend the ground properly, every way; for nothing is more certain, than that all regularity, in such cases, becomes mere pedantry.

SECT. XVI.

Another method to prevent an enemy's passing a defilè, is, by a double, or cross-fire *, which may be two ways obtained : First, by constructing the redout with the face opposed to the defilè, tenailled, that is, forming a re-entering angle *a*, so that it is defended by the fire of the sides *a b*, and *a c*, the enemy being unable to pass by the village *d*, the bridge *e*, and the dam *f*, which form the defilè, any other way than under the fire of the musketry.

The other method, is, to defend the defilè by two redouts, whose faces *a*, and *b*, command the passage, flanking each other at the same time. An additional

* When the fire of two, or more adjoining sides, crosses each other.

security

FIELD-FORTIFICATION. 23

security may be likewise had, by joining the redouts with a line *c*, leaving a passage of thirty or forty feet at each extremity, *d*, and *e*, that should the enemy unfortunately force the defilè *f*, troops may be immediately sent to drive back those who debouchè, and be able afterwards to regain their post. These passages are not covered by traverses, as in redouts, in order to facilitate such forties, or fallies, but only simply closed up with chevaux-de-frise, which may be occasionally removed.

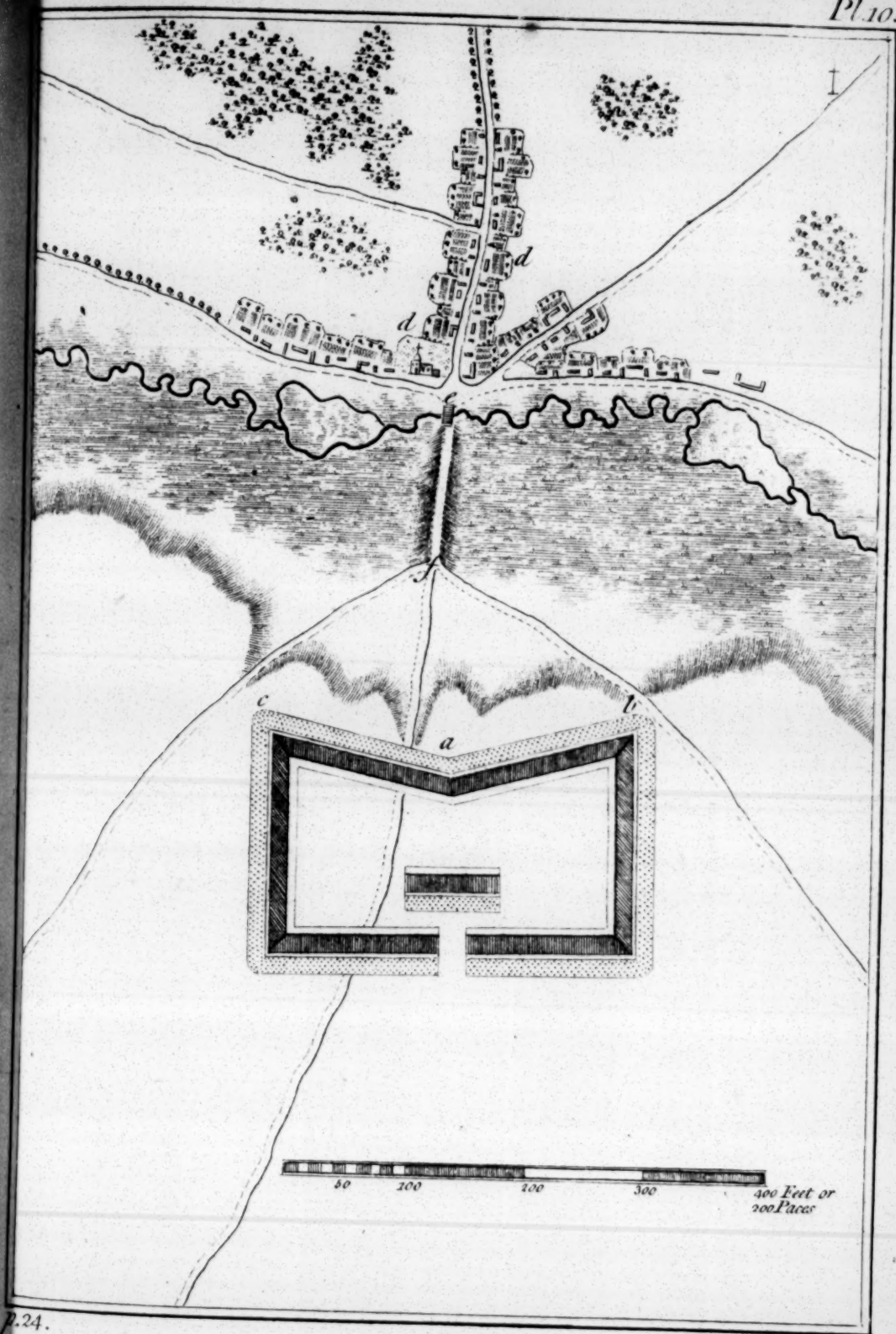
In some cases, it may be necessary to strengthen redouts of this kind by lines, carried on to where the access is almost impracticable, to prevent the enemy's turning them, and attacking the garison in the rear. For example, a line may be added from the redout on the left, to the morafs *g*, which has a small brook *b*,

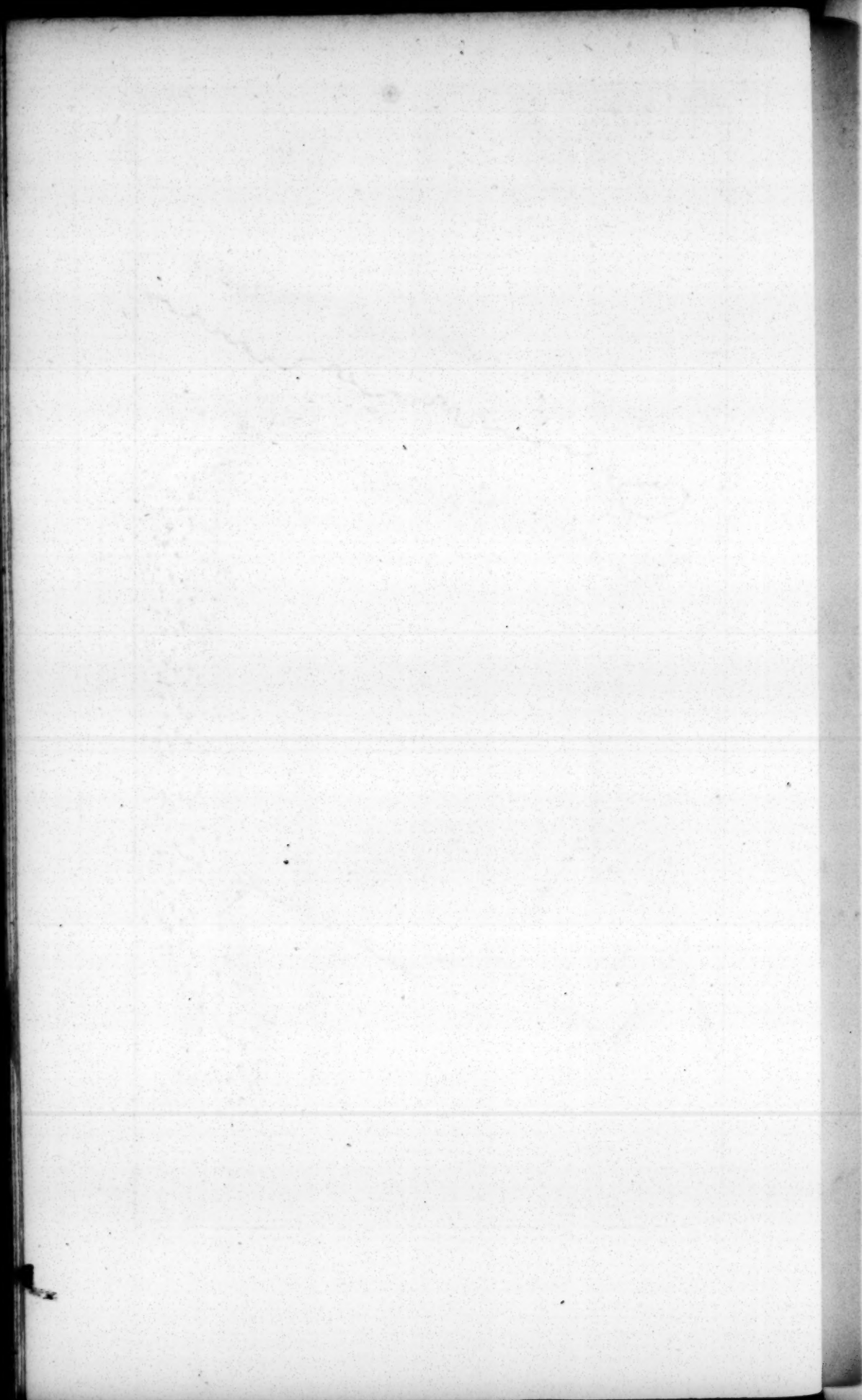
C 4

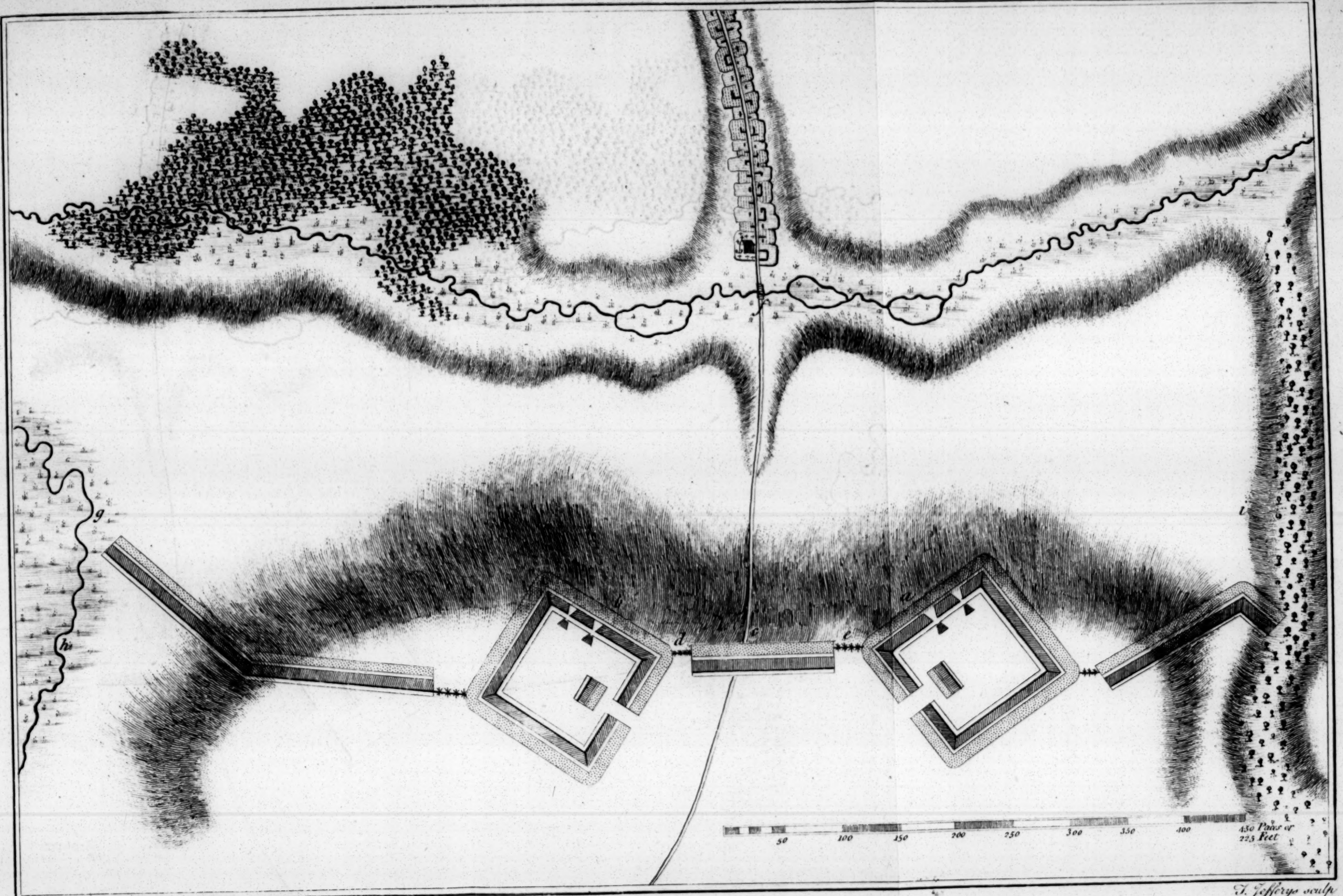
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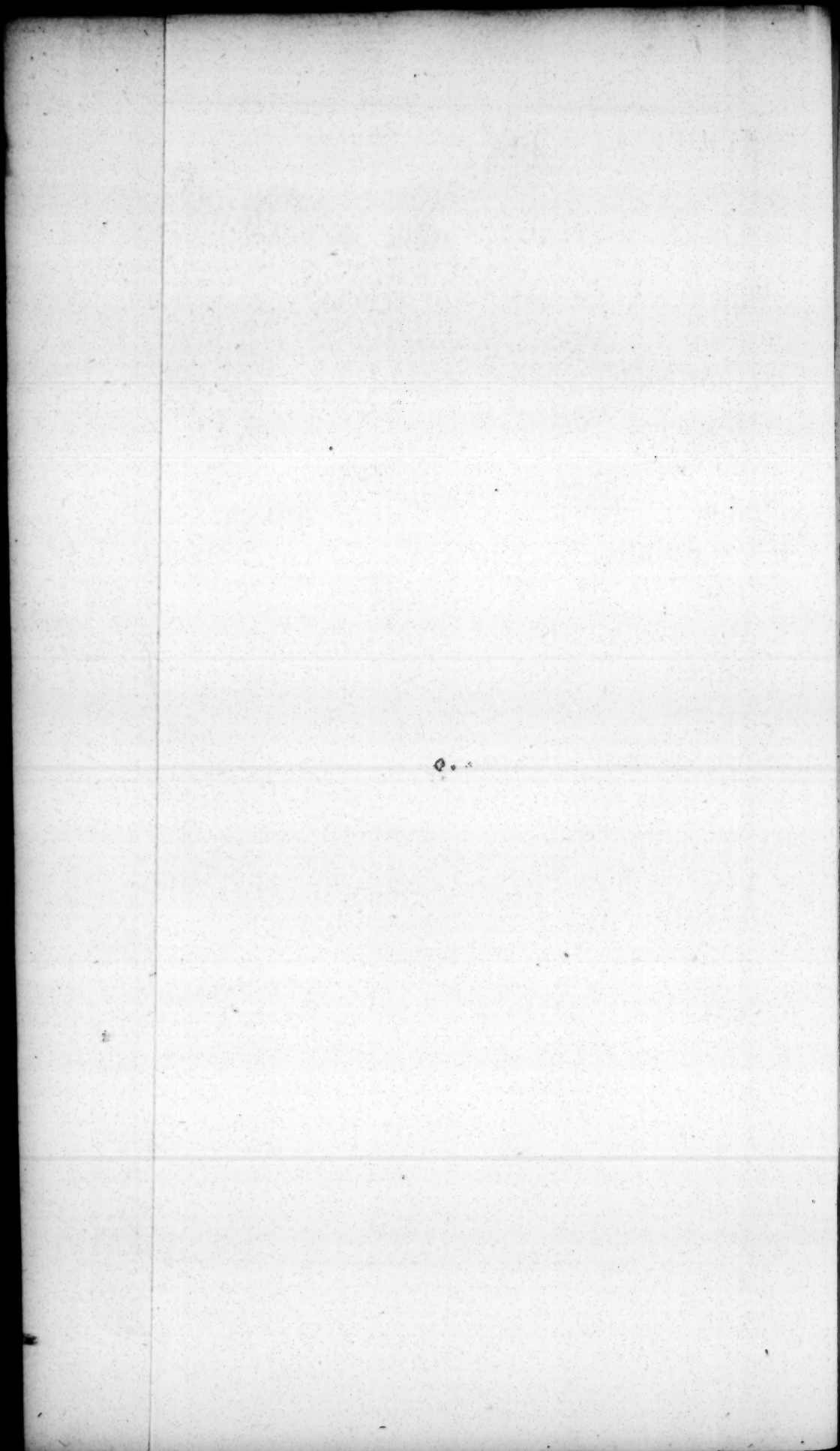
running through it: and another line from the redout on the right, to the deep ravine *i*, wherewith its flank is covered, in which the trees must be all cut down. When works are strengthened by such lines as these, care must be taken not to extend them beyond musket-shot, which is about three hundred paces; but should the distance they ought to be carried to, prove greater, a cross-fire must be obtained by breaking the line *, which will consequently improve the defense. One thing to be observed in the construction of all works intended to dispute the passage of a defilè, is, to endeavour to present, if possible, a greater front to the enemy, than they can occupy in making the attack.

* Changing the direction from that of a straight line, in order to obtain a cross-fire.









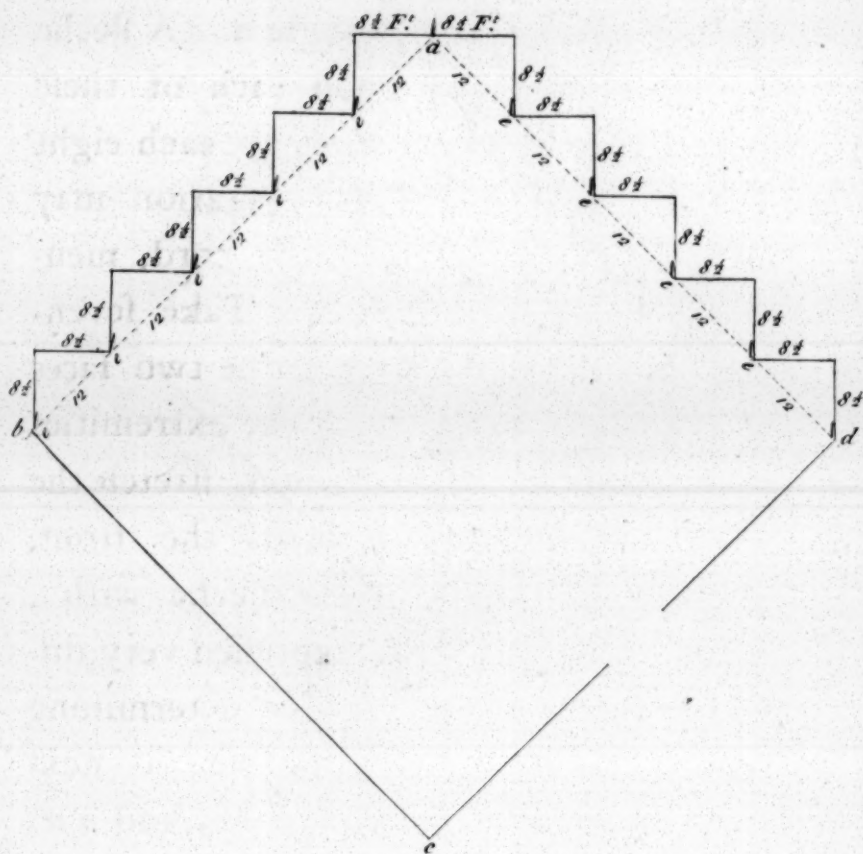
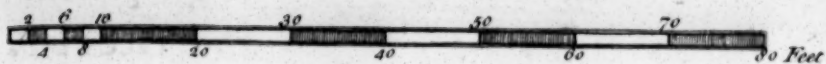
SECT. XVII.

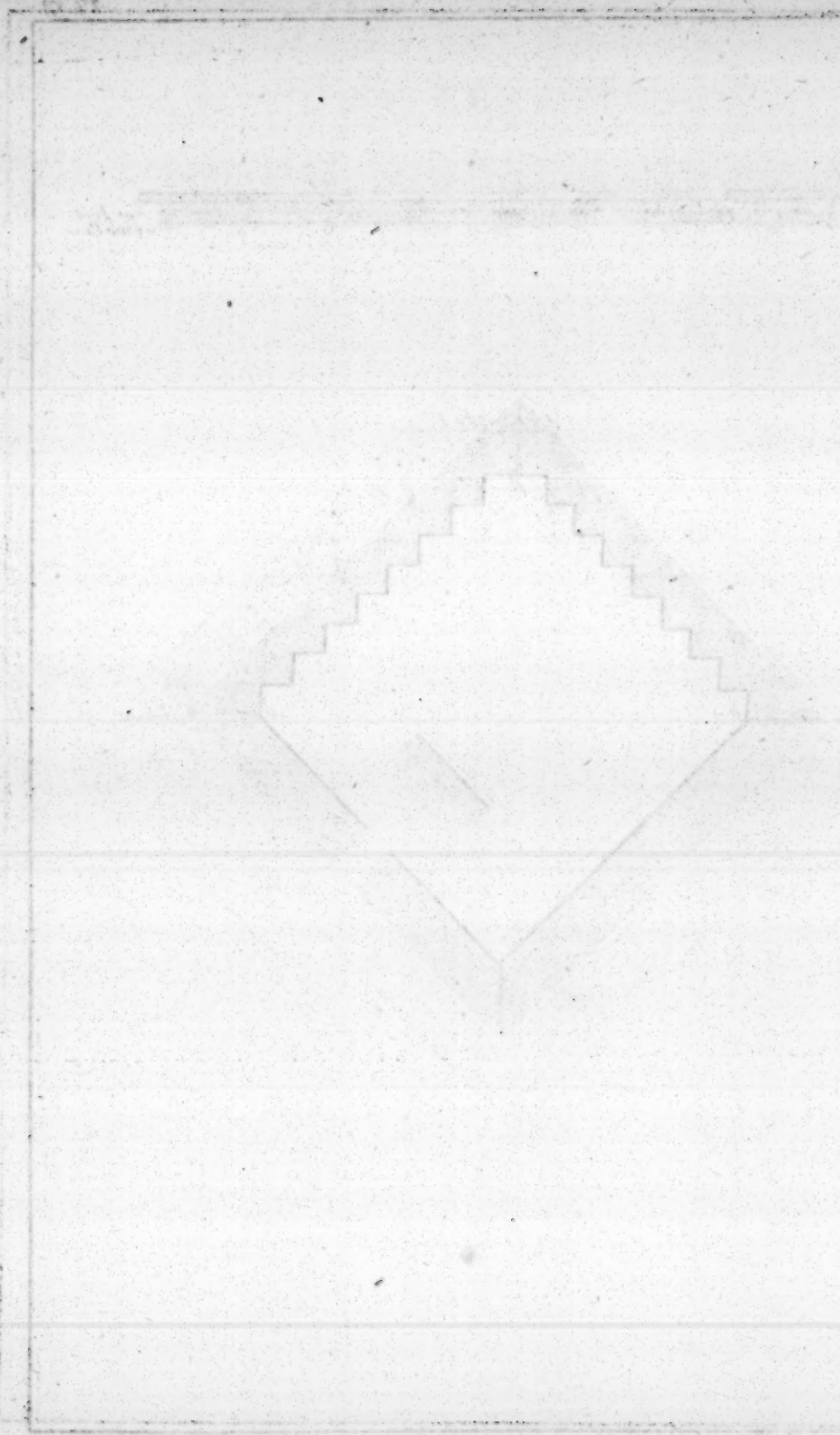
There are several other works, very proper for defending the passage of a defilè, and which indeed ought to be preferred, when unprovided with cannon; for instance, *redoutes-en-cremaillere* *, the inside line of the parapet being broken in such a manner, as to resemble the teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defilè, than if only a simple face was opposed to it, and consequently the passage is rendered more difficult. They are constructed as follows. Let us suppose two hundred and forty ^{Plate 12.} men, or one hundred and twenty file, are appointed for the defense of such a work, which is thirty file to each face. A square redout *abcd*, is traced, each face

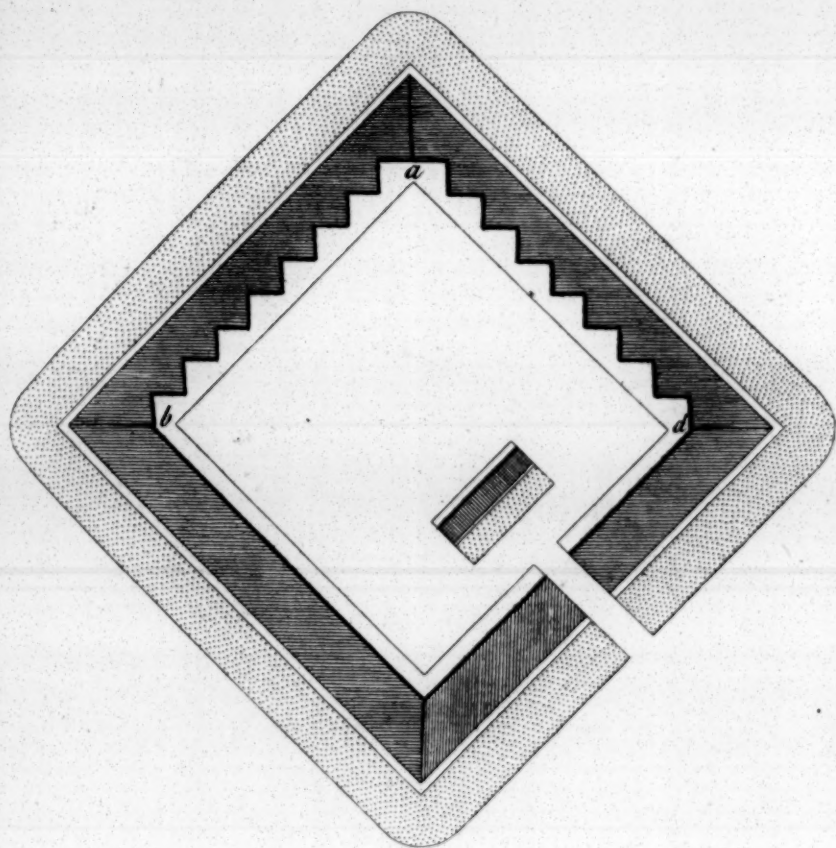
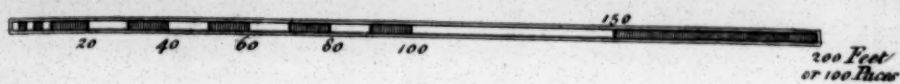
* Called so from their figure, resembling the pot-hook, and likewise the teeth of a saw.

being

being thirty paces, with an angle presented to the defilè. Divide the faces $a b$, and $a d$, into as many parts, twelve feet each, as they will allow, marking the divisions with small pickets e , being careful to begin always at the angle a . A fleche is then constructed upon each of these little divisions, whose faces are each eight feet and an half. This operation may be easily performed with the cord, mentioned in the first section. Take seventeen feet of it, the sum of the two faces of the fleche, and fixing the extremities at the ends of each division, stretch the middle of it out, towards the front, marking the angle of the fleche with a small picket. This is expressed very distinctly in the plate. A line determining the thickness of the parapet, is next traced outwards, parallel to $a b$, and $a d$; but fifteen feet, at least, are allowed, that it may not be too weak at the falliant angles







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angles of the fleches. The berme is two feet broad, the ditch twelve feet wide, and six feet deep, to have earth enough for the parapet. The banquette is not made parallel to the *cremaillere*, but to the first traces *a b* and *a d*. Plate
13.

S E C T. XVIII.

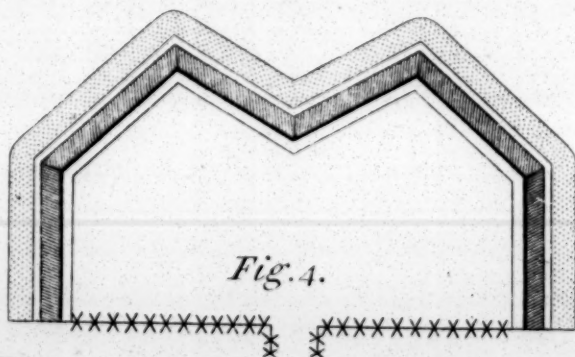
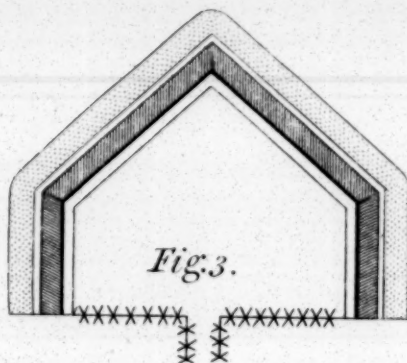
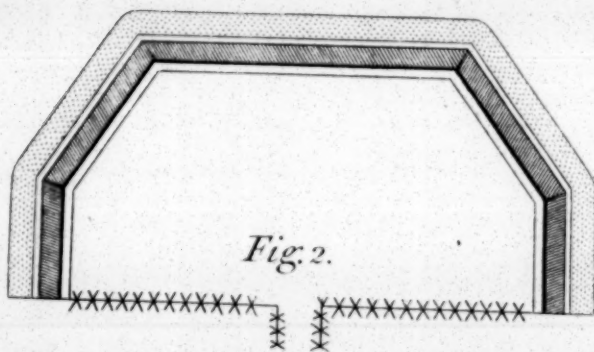
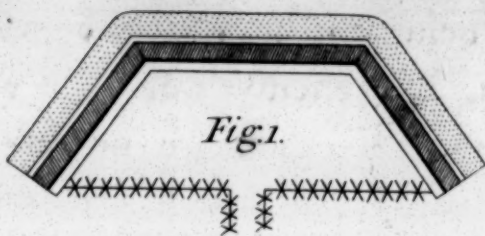
Redouts are sometimes made quite open in the rear, in order to defend defilès in front of a camp, that are too distant to be commanded by the fire of the line. These works are so constructed, and manned, as to be able to sustain the advanced posts on the farther side of the defilès, or to protect them, if forced to retire, by preventing the enemy's pursuing them. They are always erected on eminences, within reach of the cannon of the line, that the enemy may not keep possession of them. Great care is taken to support the detachments which defend

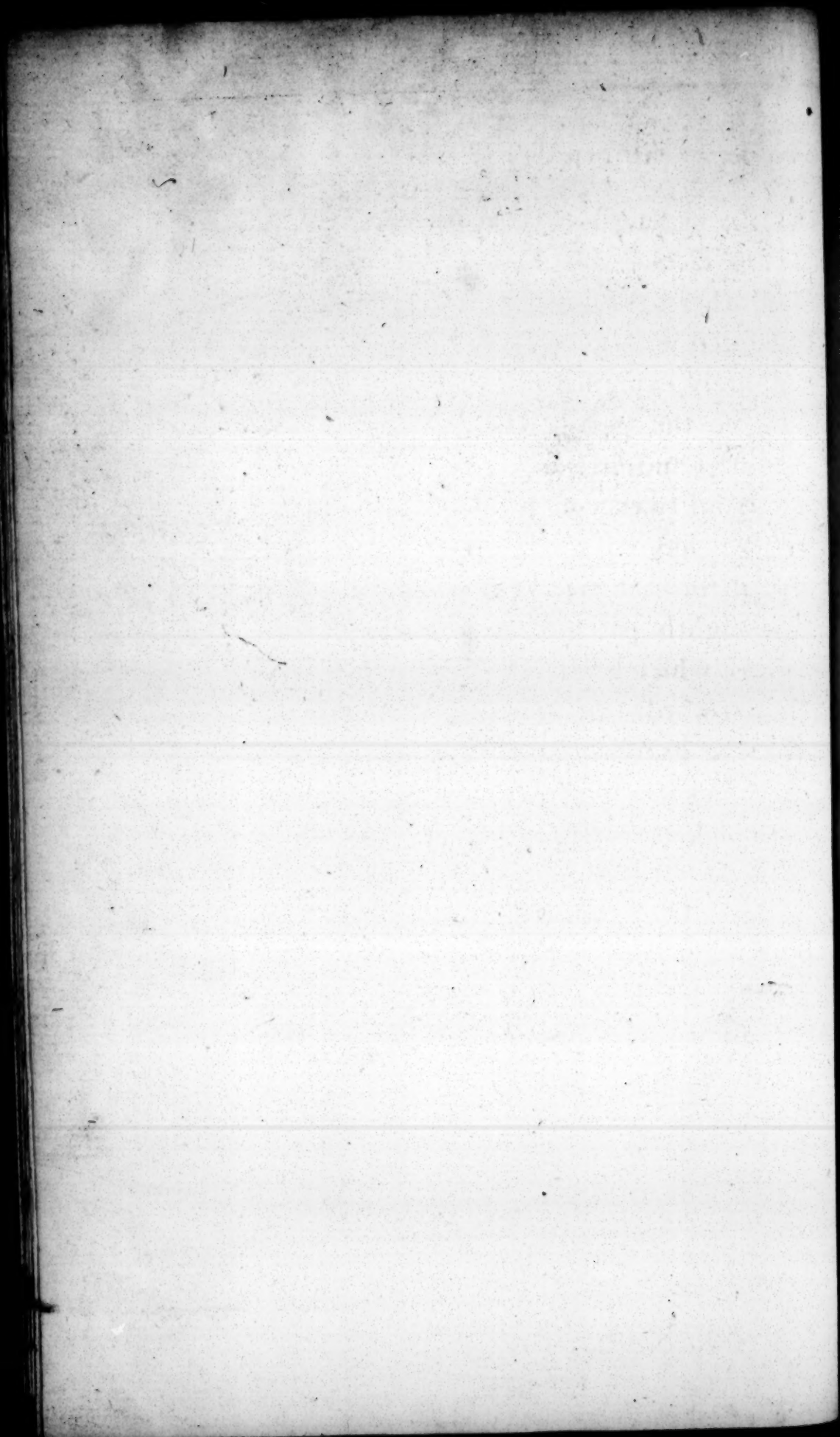
send them; but should they chance to be forced, the enemy can gain very little advantage, as they are intirely exposed in the rear to the fire of the camp: however, a row of chevaux-de-frise are placed in the opening, well fastened together with chains, or cramp-irons. If wood cannot be had to make the chevaux-de-frise, trous-de-loup are dug along the rear, to prevent a surprize in the night. The figure of these works must be deter-

Plate 14.
Fig. 1, 2, 3, 4.
mined by the nature of the ground; and the strength of the detachment appointed to defend them, fixes their dimensions.

SECT. XIX.

To construct a star-work, trace first a square redout, and divide each face into two equal parts, marking them with small pickets. From these pickets, draw a perpendicular towards the center of the work,





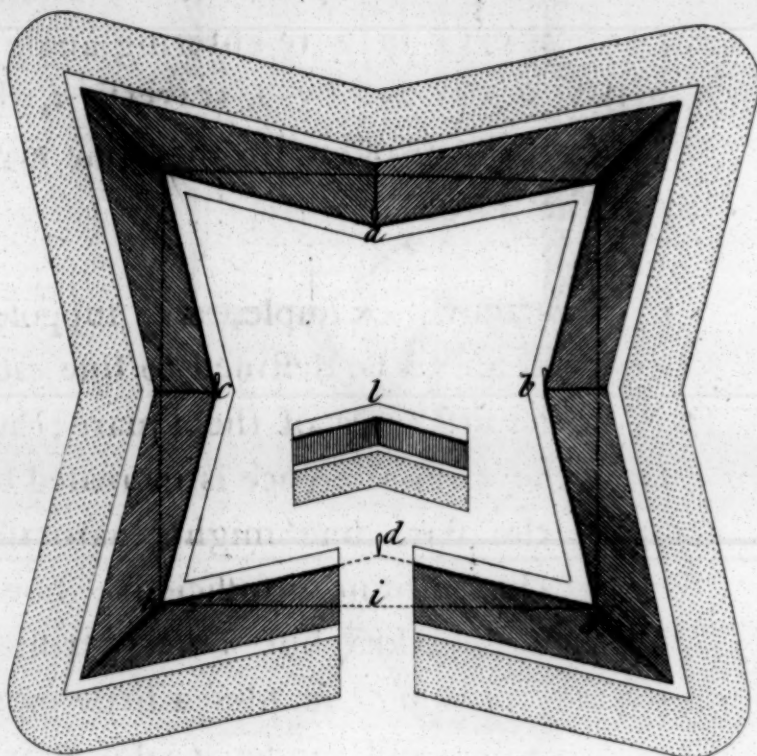
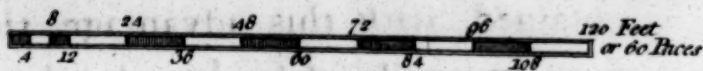
FIELD-FORTIFICATION. 29

work, in length exactly an eighth of one of the faces.—But as these directions may be rather too abstruse for a person unacquainted with geometry, the operation is minutely expressed in the plate. We will ^{Plate 15.} suppose the garison to consist of two hundred and fifty-six men, or one hundred and twenty-eight file, which is thirty-two file, and of course, thirty-two paces, for each face of the redout *efgb*. The eighth part of each face, is four paces; which being set off from their centers, towards the middle of the work, and the extremities *a, b, c, d*, marked with pickets, lines are then traced from these pickets, to the angles *e, f, g, b*, which form the line of the parapet of the star-work. The breast-work, berme, and ditch, have the same proportions as mentioned above, traced outwards, parallel to the star, as well as the banquette withinside. In these redouts, a cross-fire is obtained,

obtained, with this advantage, that the faces mutually defend each other. The entrance, as in all other works, is made in that part least exposed to be attacked, and always in a re-entering angle *i*. When it is covered by a traverse *l*, the latter must be broken, in the same manner as the face.

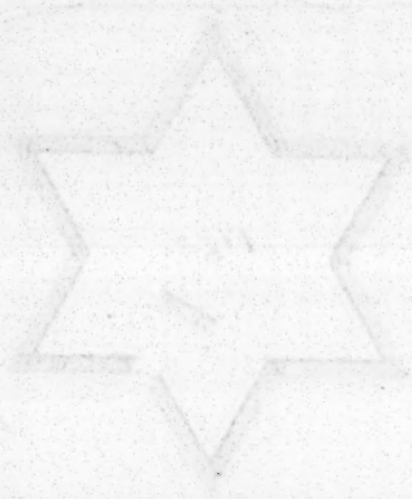
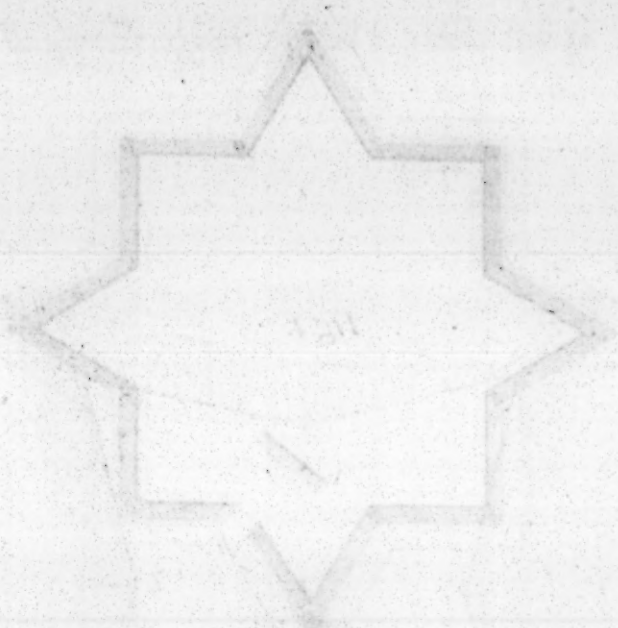
In the above example, we supposed thirty-two file to be destined to line each face, in the first trace of the square; but as now the circumference is increased by forming the star, one might naturally imagine the garison insufficient: however, as this makes but a very trifling difference, opening the files a little more than ordinary, will render it almost imperceptible, and the defense will be equally good.

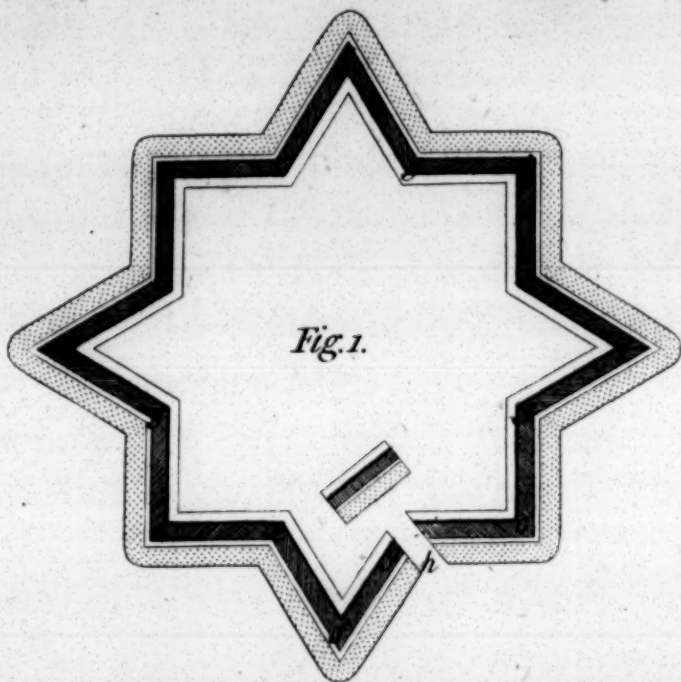
S E C T.



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THE GARDEN



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SECT. XX.

There are other kinds of star-works, constructed in the following manner. A square redout *a b c d* is first traced; every face being then divided into three equal parts, an equilateral triangle* *e f g*, is constructed on the center divisions of each. But as the line of the parapet is now increased a fourth part in its circumference, it is necessary, first of all, to make a proper calculation, because only three-fourths of the garison must be considered in tracing the square. Let us suppose one hundred and sixty file are to defend the star-fort; when therefore the square is to be marked out, as the foun-

Plate
16.
Fig.
1.

* An equilateral-triangle is that which hath three equal sides, and whose three angles are consequently equal. The sum of all the angles of every triangle, being equal to two right-angles, or 180 degrees; therefore, the angles of an equilateral triangle are each 60 degrees.

dation

dation of the work, only one hundred and twenty file, or one hundred and twenty paces, are allowed to the line of the parapet, which is thirty to each face: the fourth part, or forty file, which remain, are placed in the little equilateral triangles, when the star-work is completed, ten file to each triangle. The entrance, of course, is made in a re-entering angle, *b*.

S E C T. XXI.

Plate
16.
Fig.
2.

Star-works may be constructed in another method. Trace out first an equilateral triangle, *A B C*; divide each face into three equal parts, and then proceed as in the foregoing example, constructing small equilateral triangles on the center divisions. As to the dimensions, a fourth part of the garison must be left, to man the three triangles when the work is finished.

S E C T.

SECT. XXII.

There are a great many different figures of these kind of works, but all nearly of the same nature with what I have already described; that is to say, of more show than real utility; for though it is undoubtedly necessary that the lines of all field-works be broken, so as to obtain a cross-fire, yet it is at the same time certain, that stars methodically constructed, are more for speculation, than any real advantage that can be derived from the regularity of their figure. They are certainly of infinite less use than works which have both sides and angles unequal, but from which every thing around may be intirely discovered, and consequently defended in a direct line, and by a cross-fire. Redouts, with such essential advantages, may always make a good defense.

D

To

Plate 17. To illustrate this more fully, we will suppose an eminence, whereon a large work is to be erected, in the fortifying of which, the chief points to be observed, will be, that the different sides, or lines, of the work are so disposed, as, in general, to follow the *contour*, or edge of the height; that the view be every way free, and uninterrupted, in order to prevent the enemy from approaching under cover, and consequently occasion them the loss of many men in marching to the attack. For this reason it is necessary to destroy the houses for a certain distance around, as well as to cut down all the trees, and brushwood, that might conceal their motions. The lines of the work must flank each other, where the slope of the hill is gentle (expressed by a long faint shade *a*), to render the defense better, and the attack more hazardous; but where the access is extremely difficult,

difficult, on account of the great steepness (represented by a short dark shade *b*), or a defilè being at the bottom, nature has then done so much, that there is no need of a cross-fire. In this case, a simple line will be sufficient to protect the garison from the enemy's cannon, which it would be greatly exposed to, did they occupy the height *d*, on the opposite side of the brook. A ditch before this line becomes even unnecessary, because the earth to form the parapet may be taken from the inside; by which means the troops would, as in a trench, sooner get under cover.

Upon the left is a small wood *e*, which must be cut down, to prevent the enemy concealing himself in, or behind, it. The dam *f*, between the two ponds, must be cut through, and the sluice in the other dam, *g*, shut, in order to overflow the

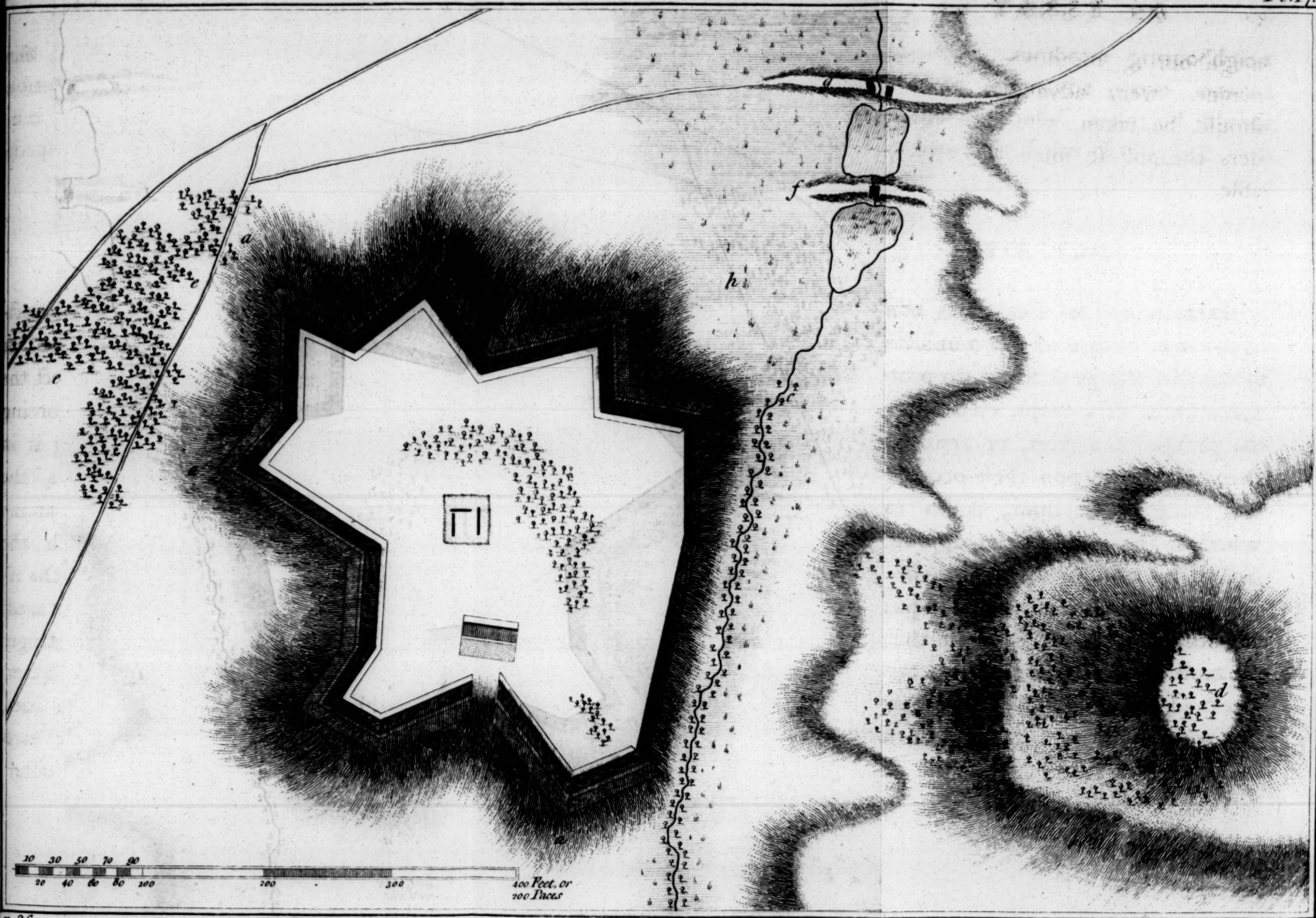
neighbouring meadows. It is in this manner every advantage of situation should be taken, which of course renders the post so much the more respectable.

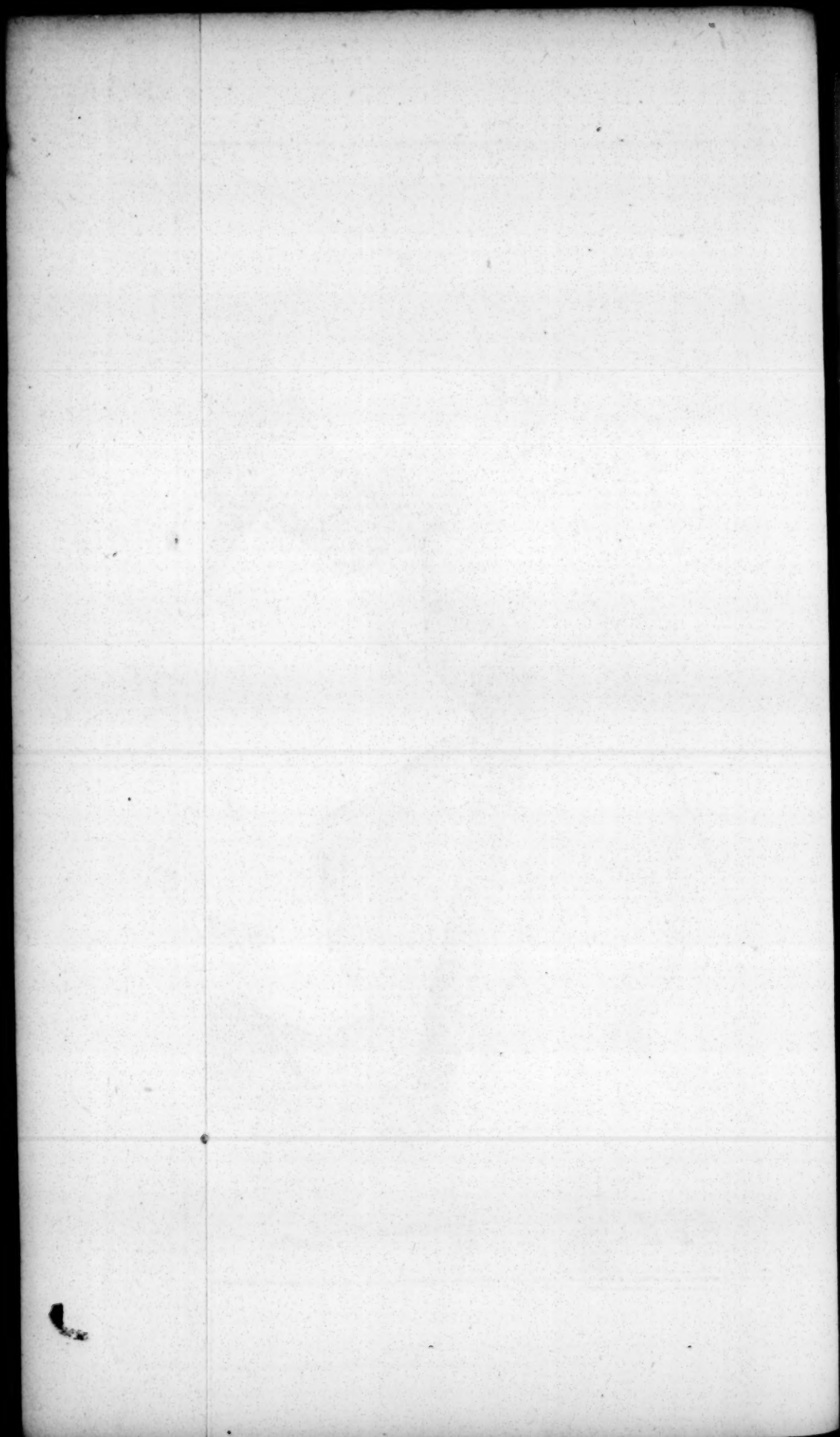
SECT. XXIII.

Tetes-de-pont are sometimes constructed to cover bridges of communication, or to contain troops destined to protect the manœuvres of a corps, either in forcing the passage of a river, or repassing it in their retreat. Upon these occasions, the first thing to be done, is to examine whether the enemy can approach the bridge by one, or both sides of the river. In the first case, a tete-de-pont must be erected on that side where the danger is most apprehended; and in the latter, the bridge must be covered on both sides, by works which mutually flank each other.

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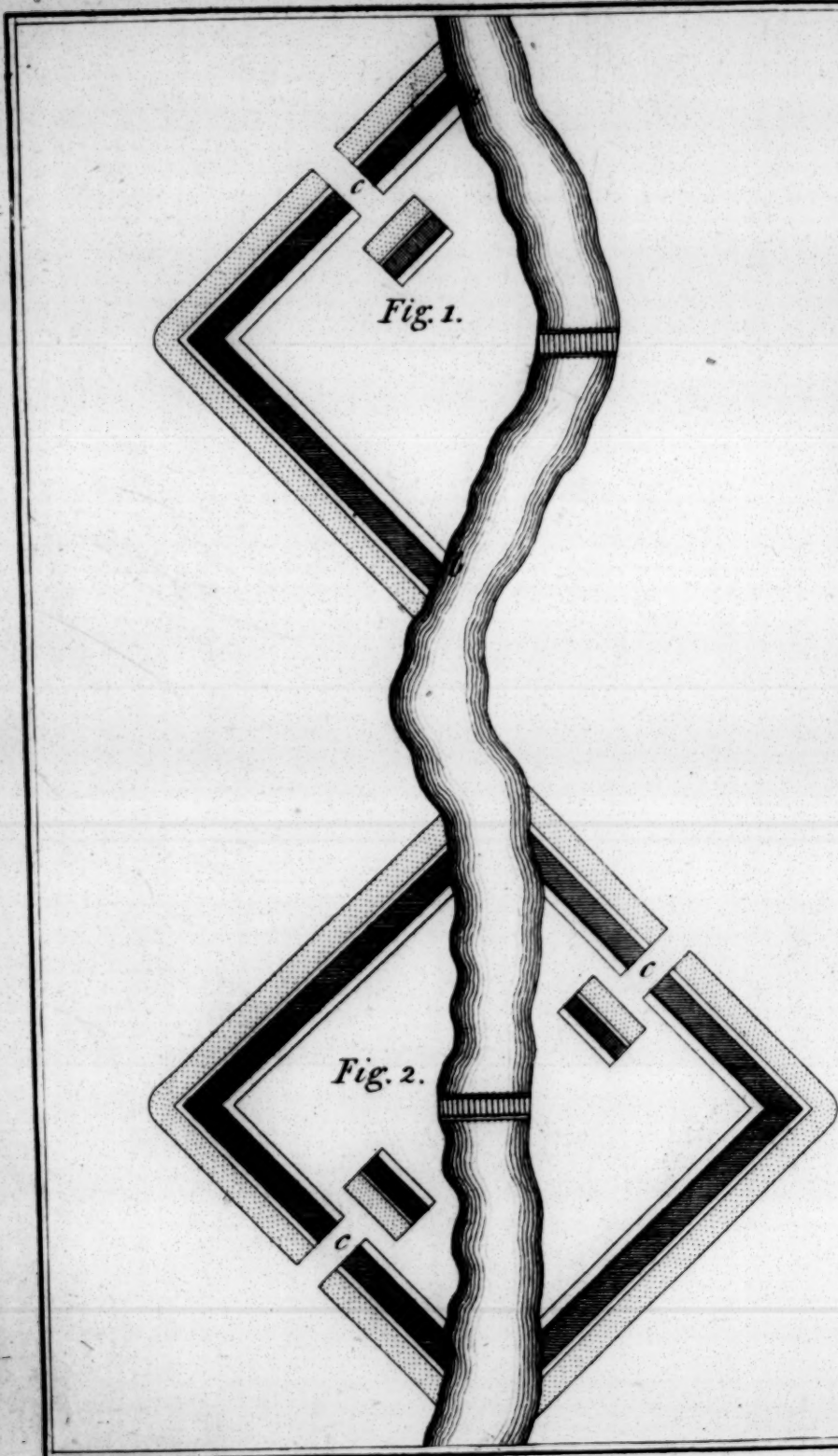
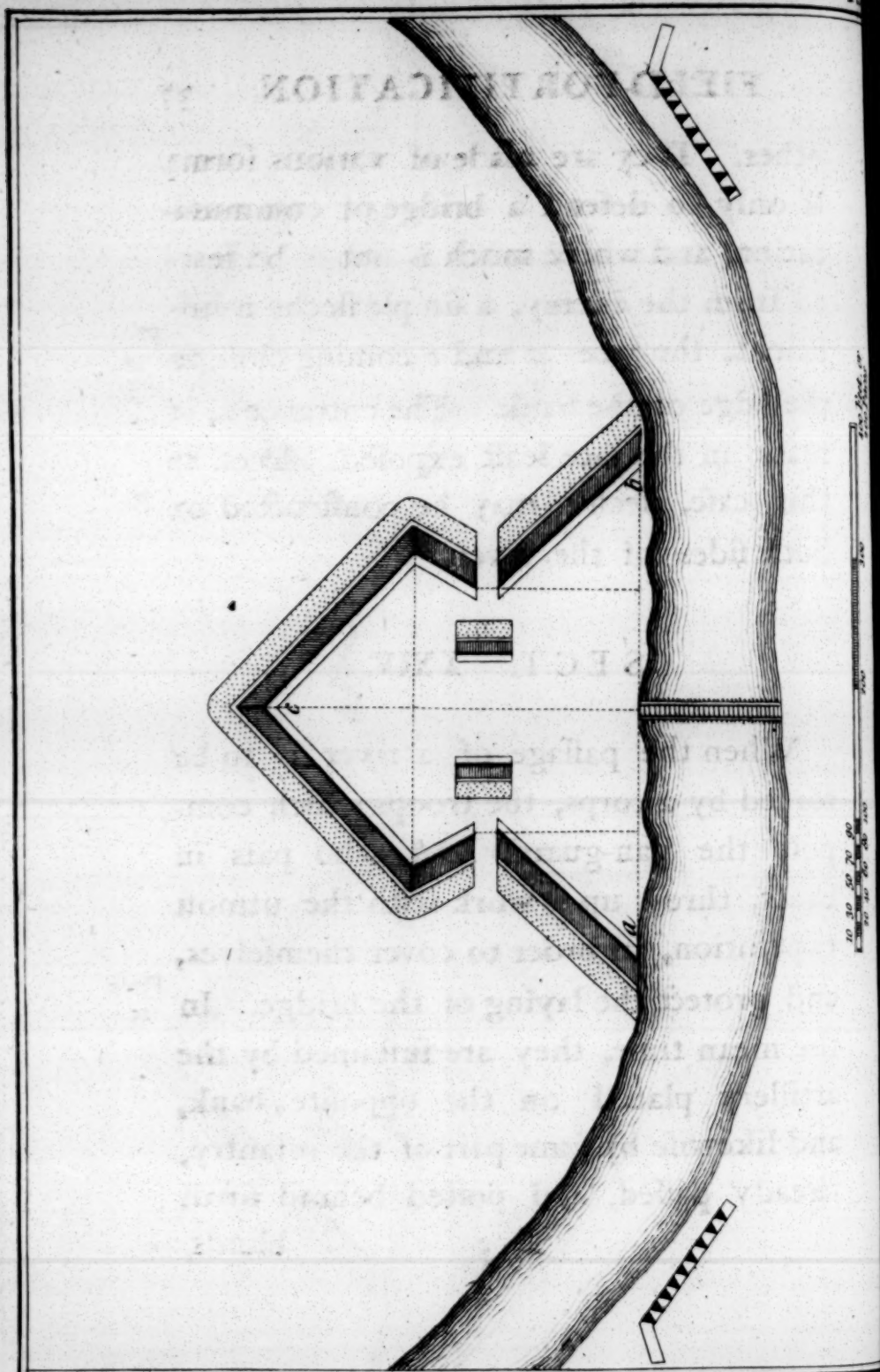


Fig. 1.

Fig. 2.





FIELD-FORTIFICATION. 37

other. They are made of various forms. If only to defend a bridge of communication, and where much is not to be feared from the enemy, a simple fleche is sufficient, the faces *a* and *b* coming close to the edge of the bank. The entrance *c*, is made in the face least exposed. Even in this case, fleches may be constructed on both sides of the river.

Plate
18.
Fig.
1.

Fig.
2.

SECT. XXIV.

When the passage of a river is to be forced by a corps, the troops which compose the van-guard, and who pass in boats, throw up a work with the utmost expedition, in order to cover themselves, and protect the laying of the bridge. In the mean time, they are sustained by the artillery placed on the opposite bank, and likewise by some part of the infantry, already passed, and posted behind small blinds,

Plate
19.

D 3

blinds,

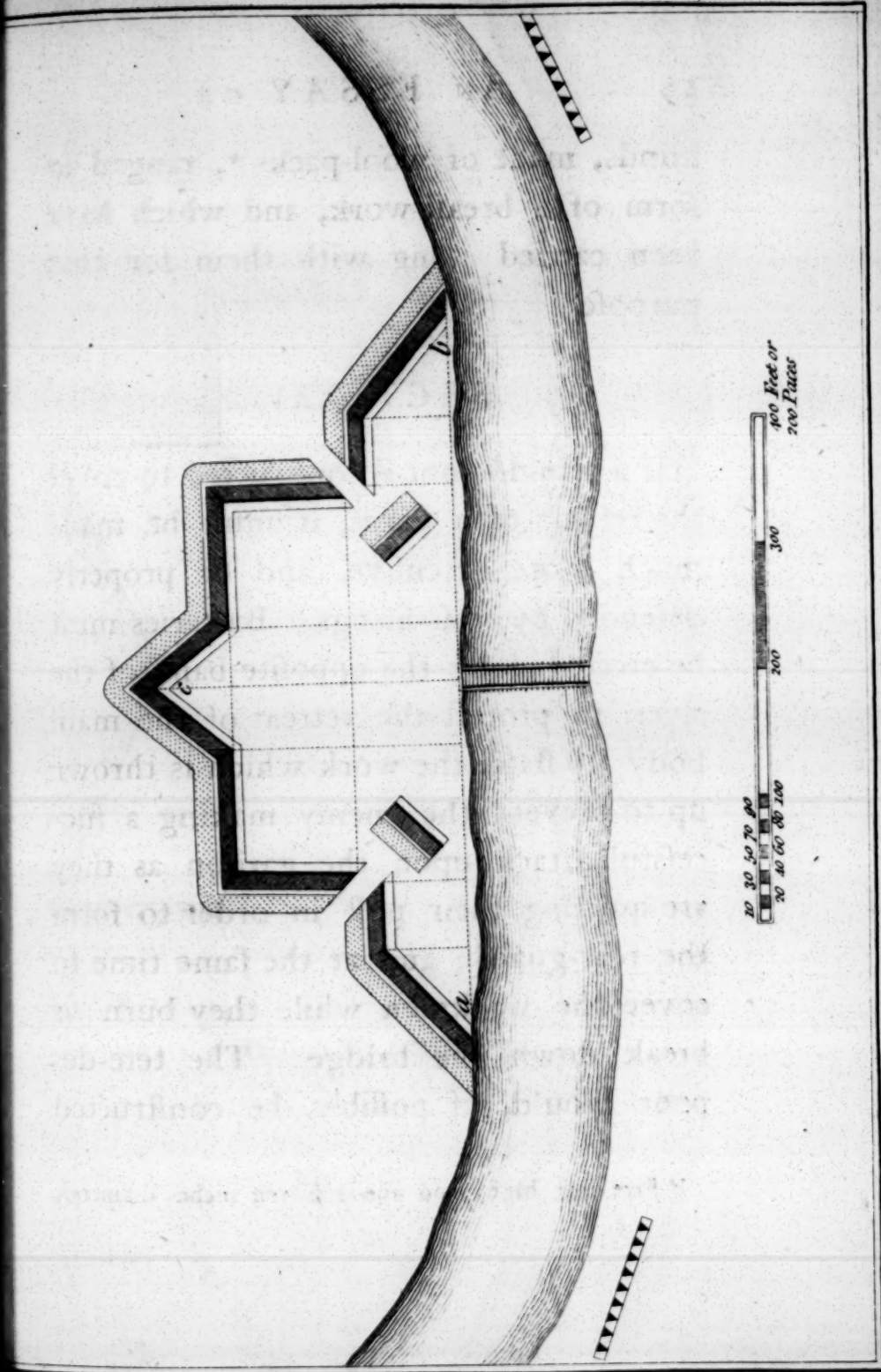
blinds, made of wool-packs *, ranged in form of a breast-work, and which have been carried along with them for that purpose.

SECT. XXV.

If a *tete-de-pont* is constructed to cover the retreat of a corps, it must be made much more extensive, and be properly defended by cross-firings. Batteries must be erected along the opposite bank of the river, to protect the retreat of the main body; to flank the work which is thrown up to prevent the enemy making a successful attack upon the garison as they are quitting their post in order to form the rear-guard; and at the same time to cover the workmen while they burn or break down the bridge. The *tete-de-pont* should, if possible, be constructed

* Five feet high, and about fifteen inches diameter.

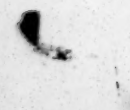
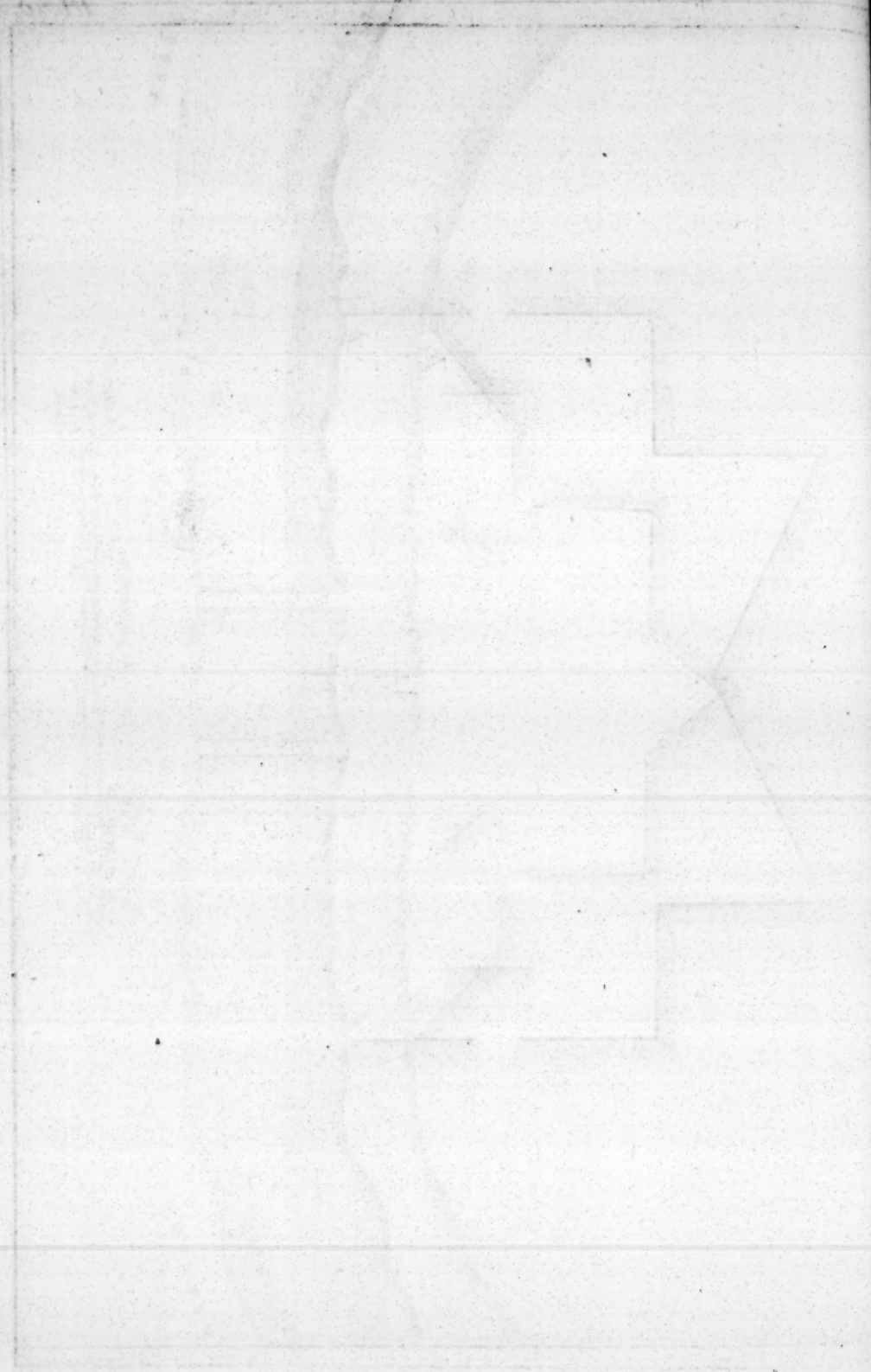
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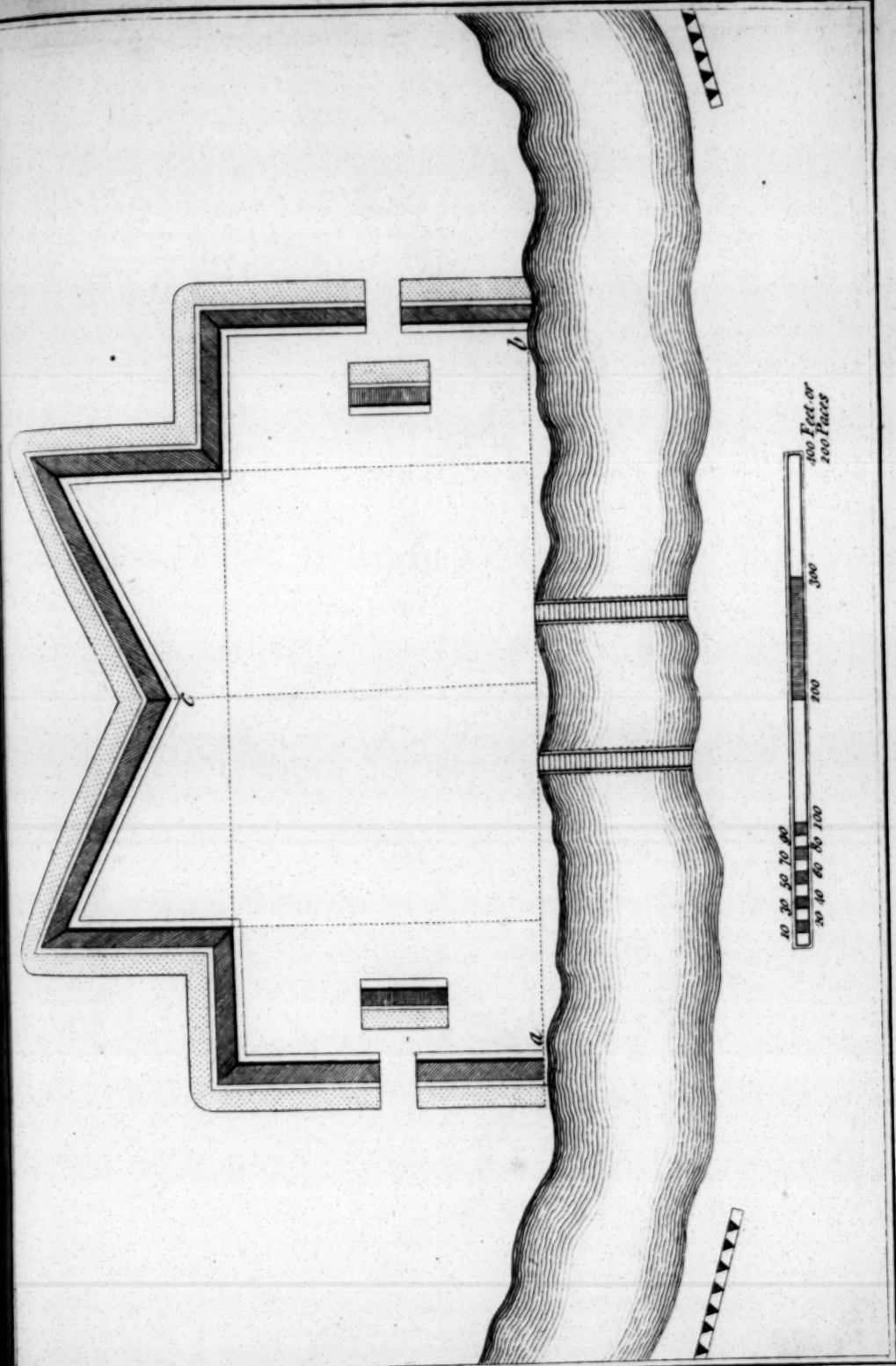


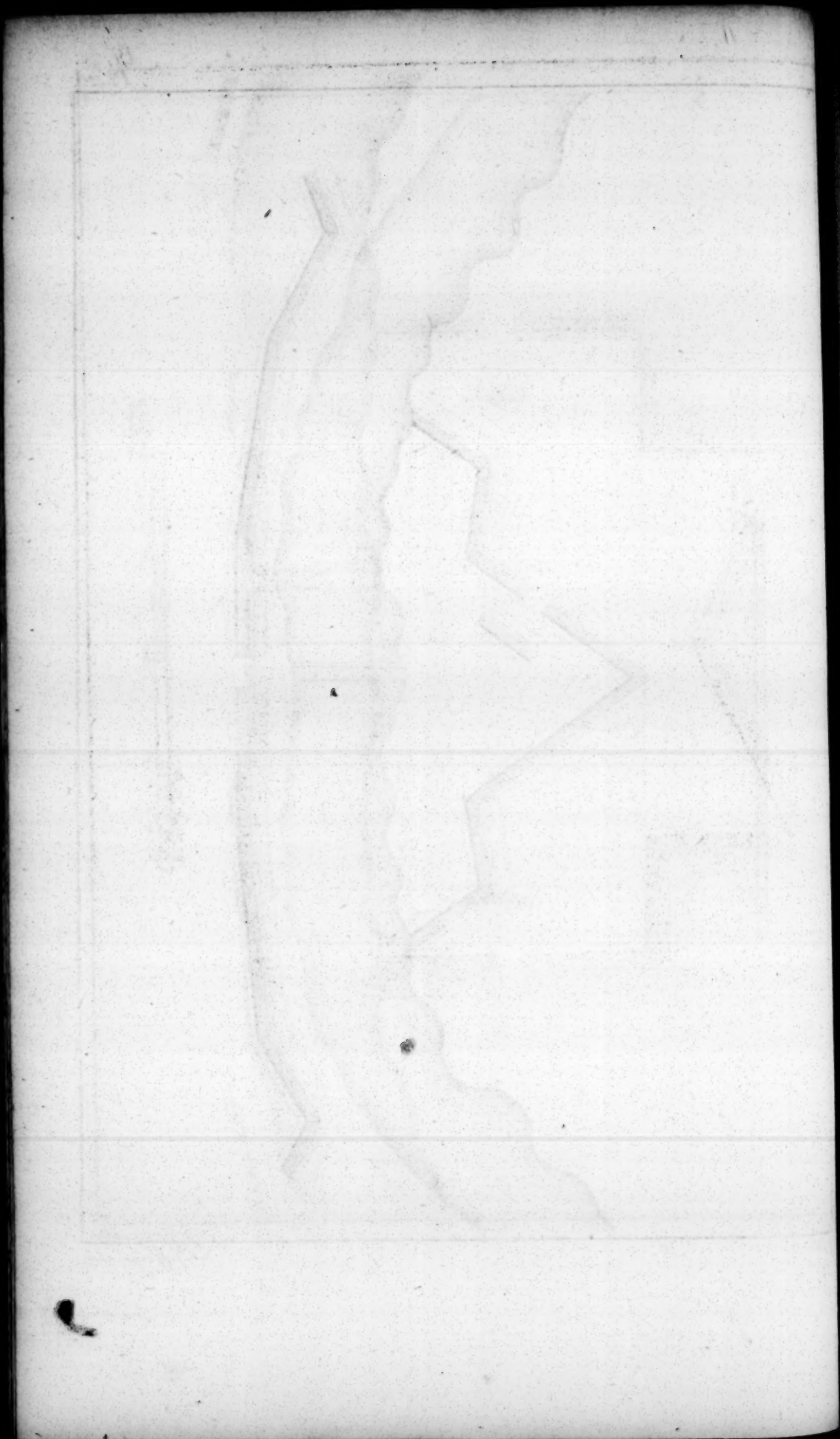
T. Jefferys sculp

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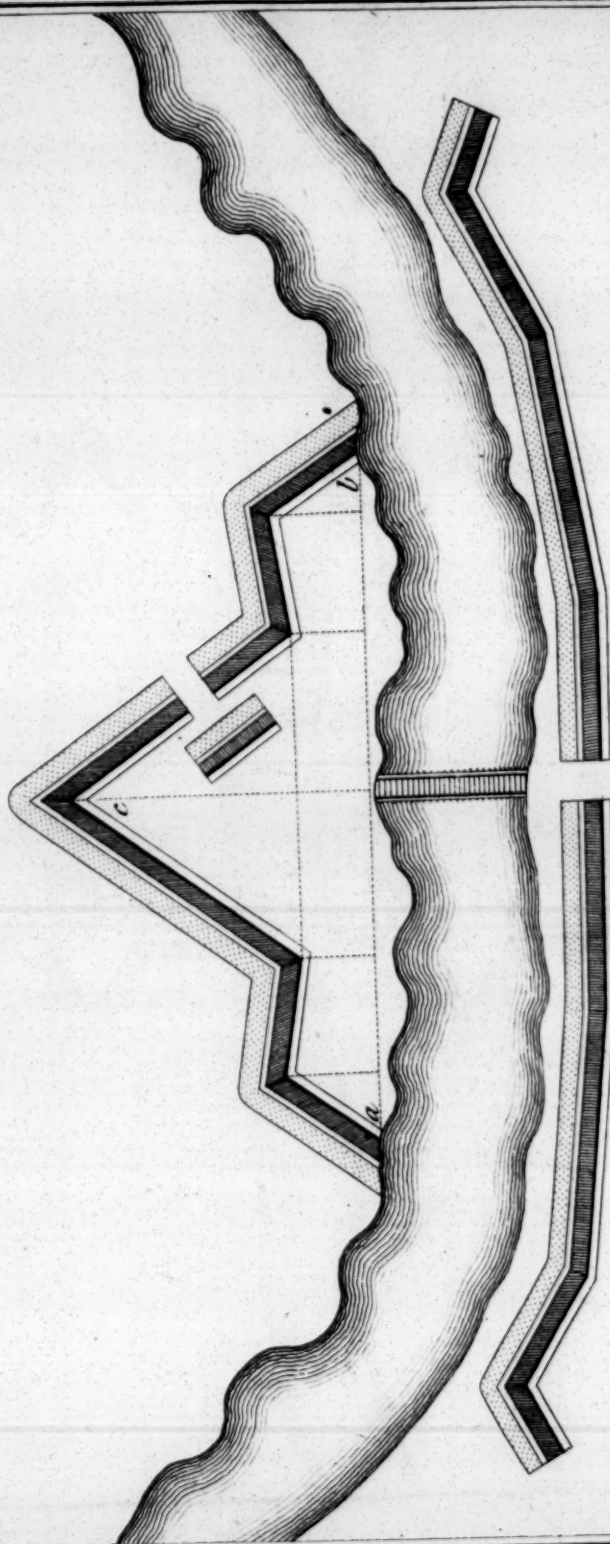
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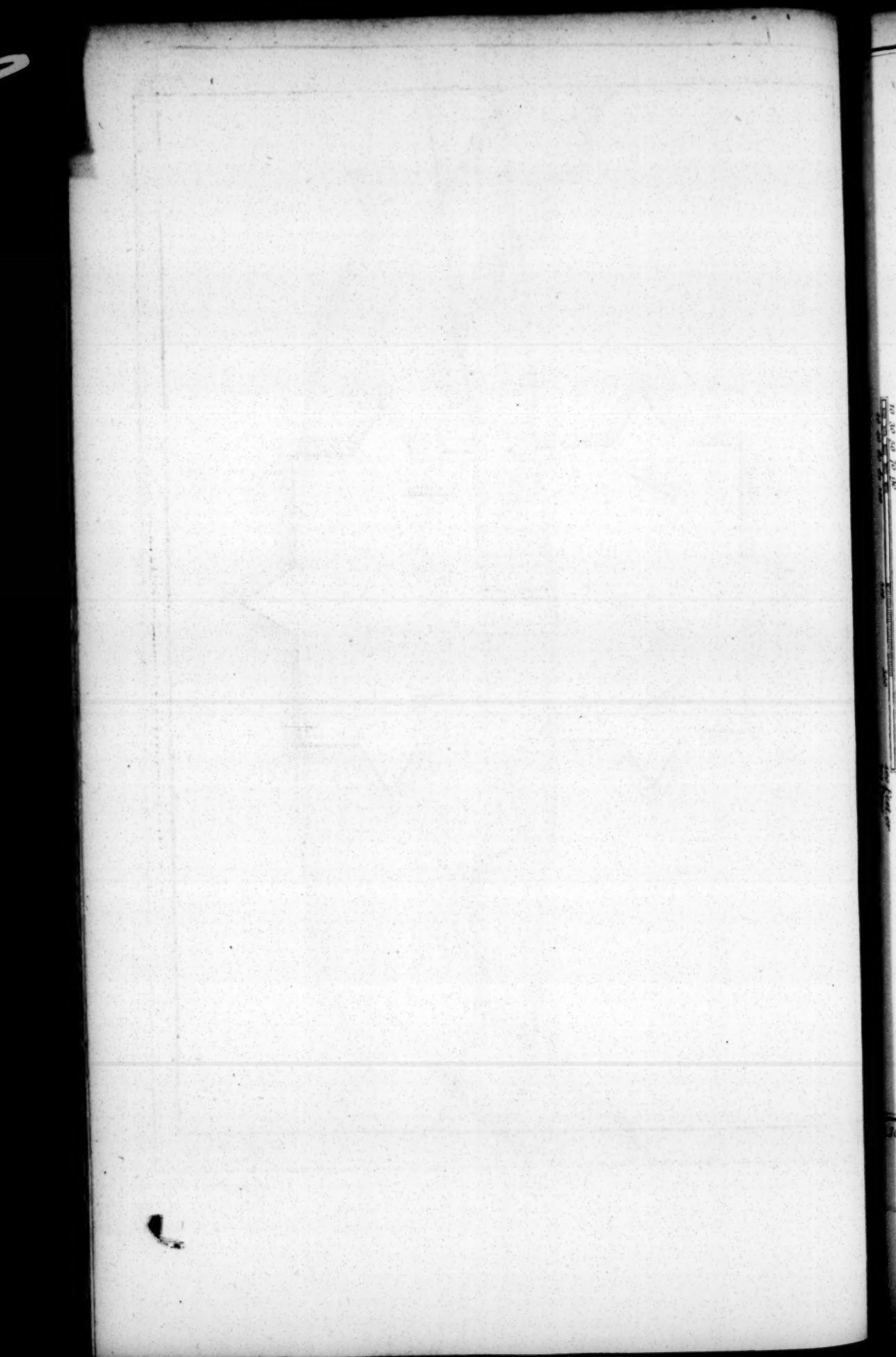


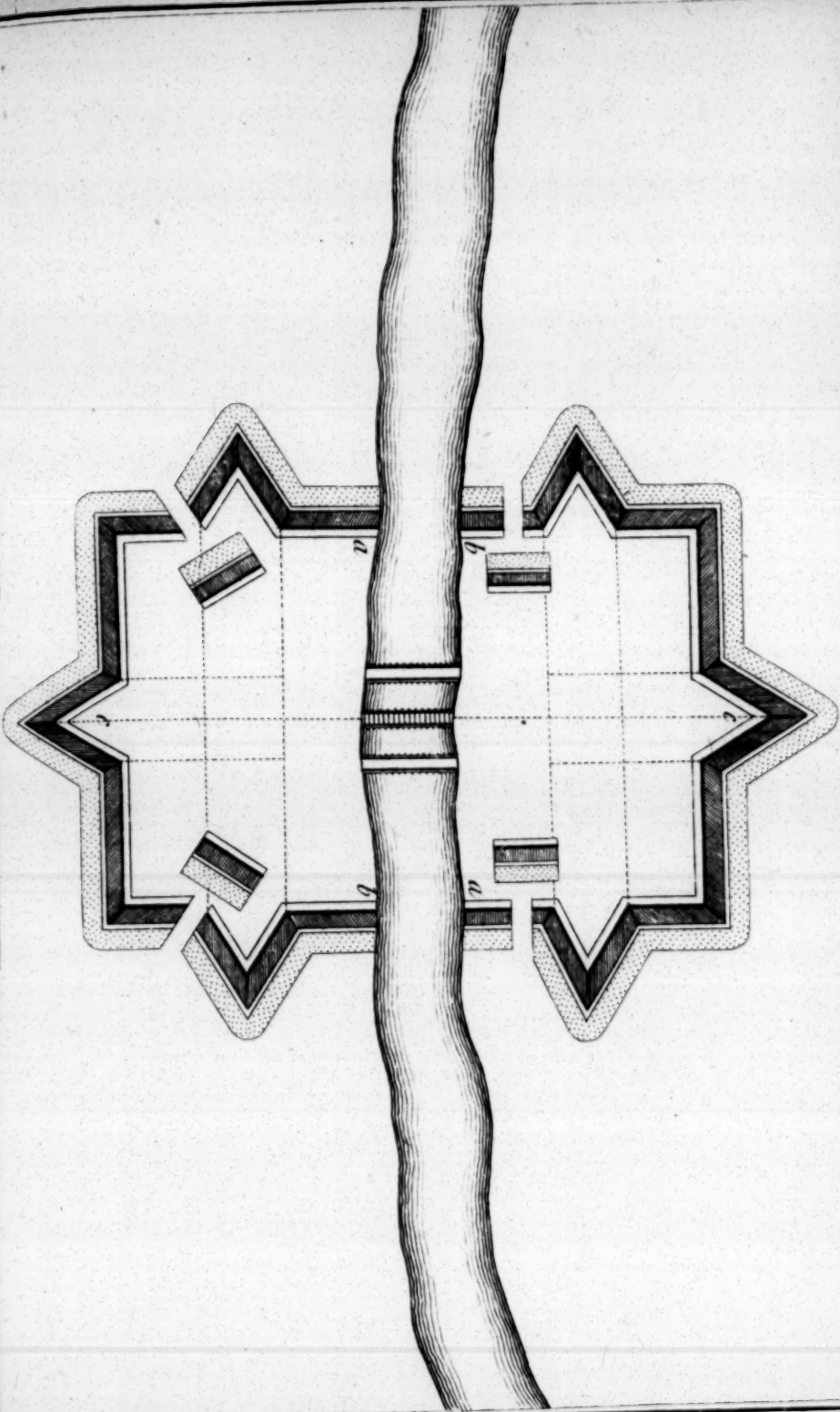




400 Feet, or
200 paces







J. Jefferys sculp.

TO THE
SCALE OF
100 YARDS

DECLARATION

THE STATE OF TEXAS, County of _____

I, _____

do hereby certify that _____

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FIELD-FORTIFICATION. 38

where the river forms a kind of re-entering angle, that the flanks of the corps, as well as those of the work, may be covered by the curve of the river.

Plate
 20.
 & 21.

S E C T. XXVI.

Lines are thrown up along the opposite bank of the river, for the greater security; and infantry are placed behind them, to protect the flanks of the tete-de-pont, the retreat of those who defend it, and the workmen employed in breaking down the bridge. However, these lines are seldom added, but when it is expected the troops will be molested in their retreat; and should there be any likelihood of the enemy's advancing in force, on both sides of the river, works must be constructed on each bank, protecting one another mutually by their fire.

SECT XXVII.

Tetes-de-pont, in general, are traced, by first laying down the base *a b*, and erecting a perpendicular on its center, of the length marked in the plates. The rest of the operation is very simple, using the cord to form the right-angles, either on the base or perpendicular. The pricked lines show the direction of every particular part, and their length in paces may be easily found by the scale.

SECT. XXVIII.

When it is necessary to cover the retreat of an army over a river, by five or six battalions, a work must be constructed proportioned to the strength of the garison; being very attentive, as in all tetes-de-pont, to have the flanks well defended. Large works of this kind may
be

FIELD-FORTIFICATION. 41

be made *en-cremaillere*, that a cross-fire Plate
24. may be obtained; but it is not at all necessary to proceed as in the construction of *redoutes-en-cremaillere*, where there are only right-angles: Here, it is much better the angles should be a little obtuse, to render the cross-fire more oblique. Necessity only requires that the flanks are broken, to prevent their being too long, and consequently ill defended. In order the better to secure the retreat of the battalions who defend a large *tete-de-pont* of this kind, sometimes a small work, capable of containing two, three, or four, companies, destined to form the rear-guard of the whole, is made within it, near to the end of the bridge, the parapet of which must always be three feet higher than the outward work, to be able to command it.

SECT.

SECT. XXIX.

When a corps, or army, has repassed a river, in presence of an enemy, as well as the greatest part of the troops who man'd the *tete-de-pont*, so that only about two companies remain ; it is very probable, when these have also retired, the enemy will endeavour to prevent the bridge being lifted, and the replacing of the pontoons on their carriages, and, indeed, will do their utmost to render even the attempt ineffectual. It is therefore absolutely necessary, these two companies, who make the rear of the whole, should remain in the *tete-de-pont*, to prevent the approach of the enemy, by their fire, while the bridge is demolishing ; and that they may retreat in safety, care must be taken to provide before-hand two rafts, to transport them a-cross the river, the moment they quit the work. These
rafts

rafts are made in the following manner. As many beams, joists, and planks (if possible fir), are to be collected, as when framed, and put together, will contain space enough for a company to draw up upon. The joists are fastened a-cross the beams, by means of strong wooden pins, and above the joists the planks are nailed. A ledge of wood is then put round the whole, about six inches broad; and the seams are every where to be well pitched, to keep out the water. Wool-packs are next to be laid along the sides of the rafts, towards the enemy, supported by pickets nailed to the ledge.

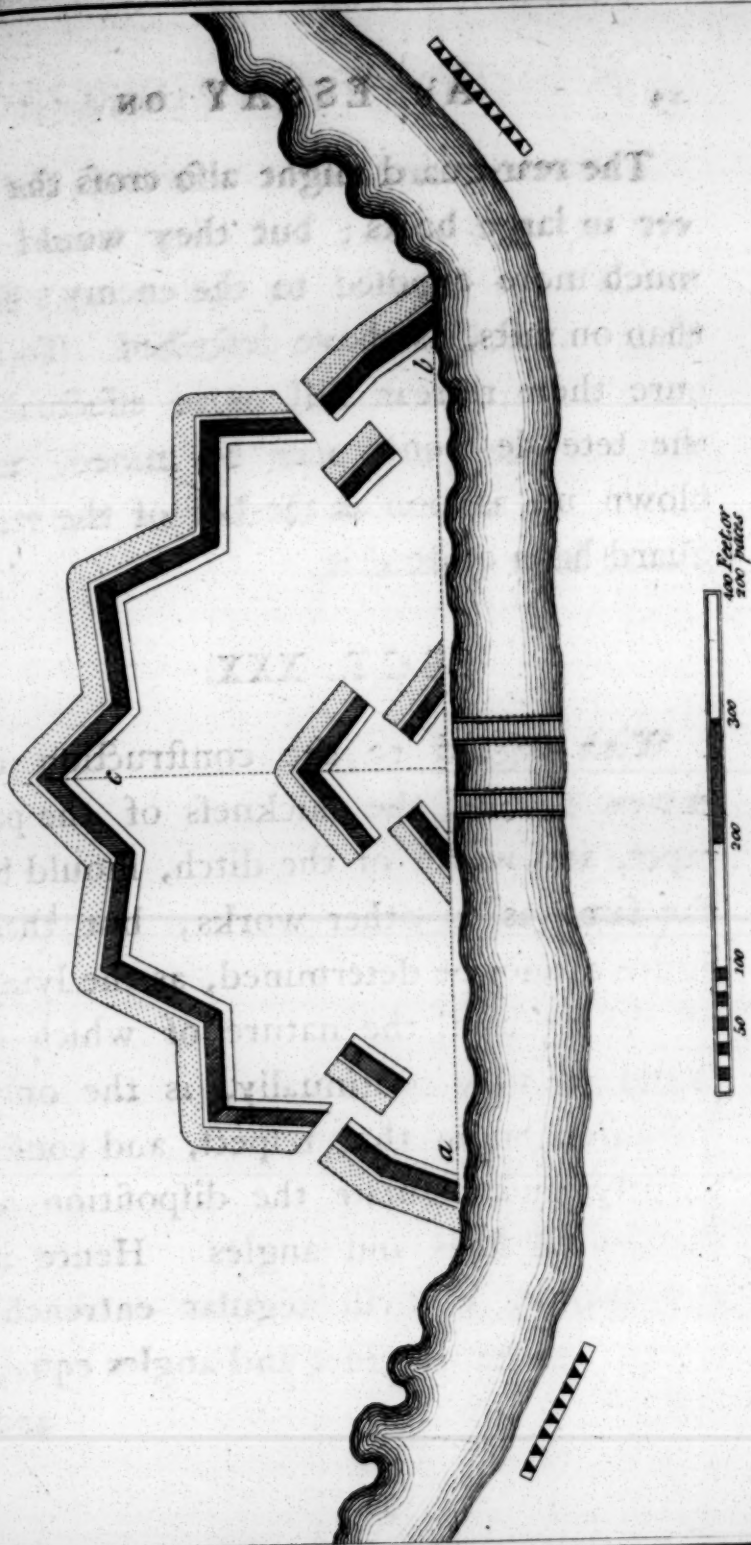
The two remaining companies get behind this kind of breast-work, and gain the opposite bank either by means of oars, or a rope. Some artillery, and a detachment of infantry, are posted to cover their retreat.

The

The rear-guard might also cross the river in large boats ; but they would be much more exposed to the enemy's fire, than on rafts, as above described. To secure their retreat still more effectually, the *tete-de-pont* may be mined, and blown up as soon as the last of the rear-guard have quitted it,

SECT. XXX.

With regard to the construction of entrenchments, the thickness of the parapet, and width of the ditch, should be the same as in other works ; but their figure cannot be determined, as the lying of the ground, the nature of which is found to vary continually, is the only just direction in that respect, and consequently must regulate the disposition of the several lines and angles. Hence it will appear, that all regular entrenchments, having the sides and angles equal,
and



T. Jefferys sculp

ORTHOGONALITY

where the ground is uneven
very defective. There are no
a few general rules, which
are given in the following.

1. The first rule is that the
ground should be level.

2. The second rule is that the
ground should be of a uniform
color.

3. The third rule is that the
ground should be of a uniform
height.

4. The fourth rule is that the
ground should be of a uniform
width.

5. The fifth rule is that the
ground should be of a uniform
length.

6. The sixth rule is that the
ground should be of a uniform
depth.

7. The seventh rule is that the
ground should be of a uniform
width.

8. The eighth rule is that the
ground should be of a uniform
length.

9. The ninth rule is that the
ground should be of a uniform
depth.

10. The tenth rule is that the
ground should be of a uniform
width.

11. The eleventh rule is that the
ground should be of a uniform
length.

12. The twelfth rule is that the
ground should be of a uniform
depth.

13. The thirteenth rule is that the
ground should be of a uniform
width.

14. The fourteenth rule is that the
ground should be of a uniform
length.

15. The fifteenth rule is that the
ground should be of a uniform
depth.

FIELD-FORTIFICATION. 45

and yet where the ground is uneven, must be very defective. There are, nevertheless, a few general rules, which may be reduced to the following, viz.

- I. The angles should be neither too acute, nor too obtuse.
- II. Every line must be defended by the fire of another.
- III. When the ground is very irregular, the lines must be so disposed, that the slopes, and even the very bottom of the heights, may be intirely commanded.
- IV. But when the above is impracticable, either on account of the great steepness, or the ground being interrupted by many small eminences, or cut with ravines, it should be endeavoured, as much as possible, to flank

flank the parts concealed by other lines.

V. The wings, or extremities, of the entrenchment must be well defended, to prevent the enemy's turning them.

VI. Double attention ought to be given to those places where an attack appears most practicable, and every kind of obstacle prepared to oppose the enemy; such as chevaux-de-frise, palisades, trous-de-loup, abbatis, fougasses, &c.

VII. If the ground happens to be broken by heights, or large hollows, salient or projecting works must be carried upon the former, well furnished with artillery; but the gorges of the hollows, that is, where two heights form a narrow bottom, should

should be defended by re-entering angles.

VIII. It must not be neglected, to construct close redouts at certain distances, that should the enemy force any part of the entrenchment, they may not be able to resist the fire which takes them in flank, but soon be obliged to give up any advantage they may have gained, and retire.

IX. The ground should be chosen in such a manner, that no part of the entrenchment may be commanded by any heights, either in front, or on the flanks, otherwise the troops will never be able to make the least movement with safety.

X. Openings of thirty or forty paces, must be left here and there, for the troops to advance in front. They should

should always be made in re-entering angles, and never in the falliant, covered either with fleches or traverses, or closed up with chevaux-de-frise.

XI. The roads in the rear of the entrenchment should be good. If they are not naturally so, they ought to be immediately repaired, that an easy retreat may be made, if circumstances require it.

The following example will illustrate fully what is mentioned above.

Plate 25. The right flank of the entrenched camp is covered by a deep morassy vale *a*, a muddy impassable stream running thro' it. The right wing occupies a hill, on which a redout *b* is erected, the *contour*, or edge, being exactly followed, in the disposition of the lines. A small wood *c*,
in

in front of the redout, is cut down, to have the view quite unconfined. Upon the left of the hill, just at the bottom, lies the village of Weilheim, with two fleches thrown up in its front, joined by a line *d*. That the redout upon the hill may be readily supported from camp, bridges of communication *e*, are laid over the brook. In front of Weilheim, is a gentle rising *f*, with the village of Mansfeld at the bottom of it, intirely furrounded by defilès, and hollow-ways *g*. An advanced post is made of this height, fortified with a work in which four hundred men are placed, with some pieces of cannon. It is only closed in the rear with chevaux-de-frise, that if, unfortunately, the garrison should be forced, the cannon of the entrenchment may soon oblige the enemy to abandon the post; which indeed is only occupied at first, to prevent their taking possession of it in the night, and

E

erecting

erecting batteries to fire upon the camp. The entrenchment *b* is carried along the heights from Weilheim to Stemern, according to the disposition of the ground, and so constructed, that all the different parts mutually protect each other. Some close redouts *i* are likewise placed here and there, in the line of the entrenchment. The entrance into Stemern is covered by a redout *l*, open in the rear, and commanded by the lines on the heights above the village. The little wood *m*, in its front, is cut down, to clear the view, and give scope to the fire of the works.

The entrenchment is carried from Stemern to some high hills, covered by a thick wood *n*, which protects effectually the left flank, as the wood is almost impassable ; however, for still greater security, a large abbatis *o*, is formed quite a-crofs the wood, defended, at certain
dif-

FIELD-FORTIFICATION. 51

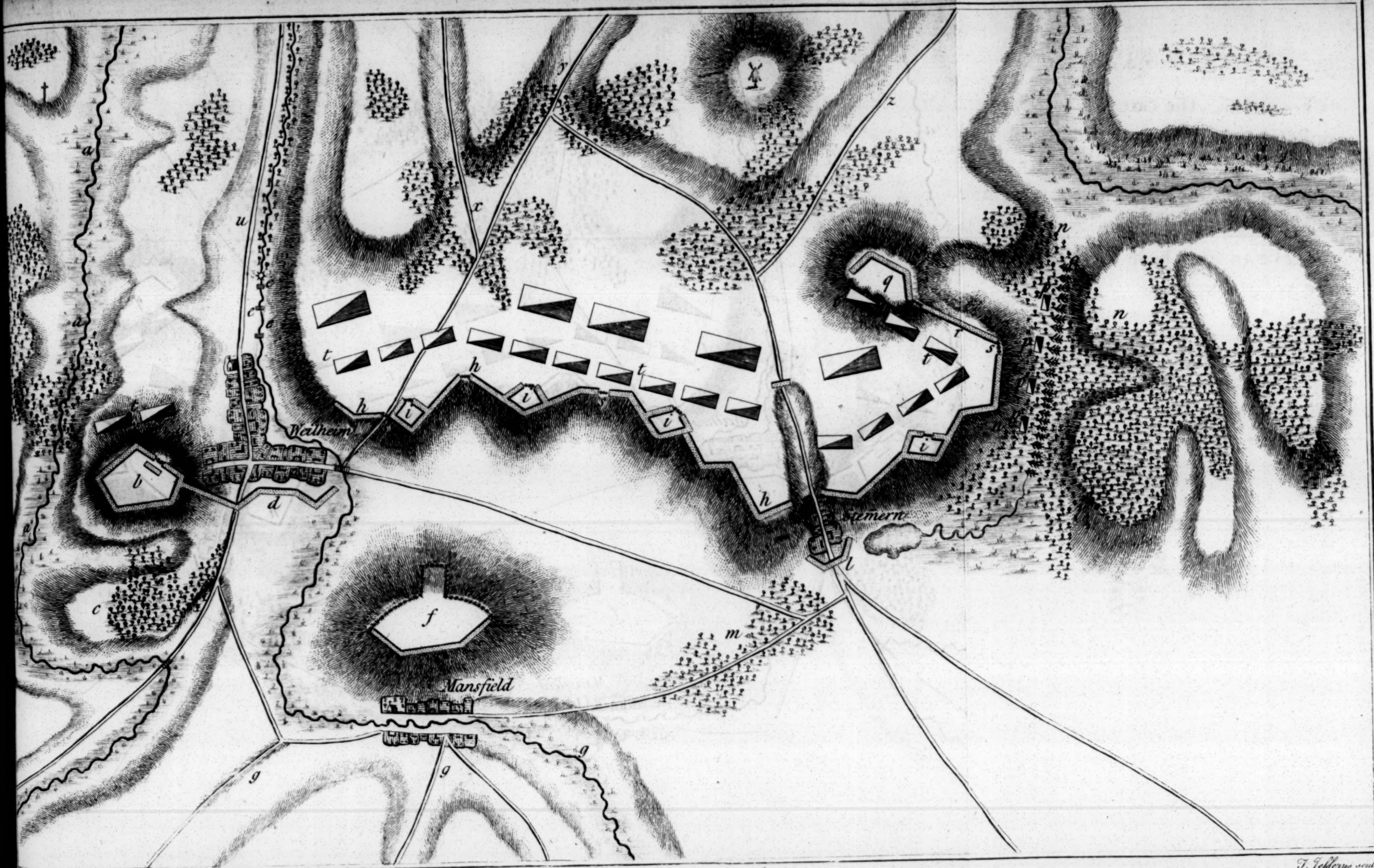
distances, by piquets of infantry *p*. The gorge, or opening, in rear of the left wing, is commanded by a redout *q*, constructed on a rising ground, and a line of communication *r*, carried from this work to the left of the entrenchment. Several openings *s*, about thirty paces wide, are left in the lines, shut with chevaux-de-frise, that cavalry may be immediately sent in pursuit of the enemy, when they happen to be repulsed.

The troops *t*, are encamped behind the entrenchment, the infantry forming the first line, and the cavalry the second. Weilheim is occupied by two battalions, and Stemern by one. In rear of the camp are four roads, *u*, *x*, *y*, *z*, by which a retreat may be easily made, when necessary.

I confess, the care of fortifying such posts is generally entrusted to engineers; but an officer who wishes to obtain a thorough knowledge in ground, and to excel in his profession, ought of course to have an idea how these kind of works are to be executed.



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F. Jefferys sculp

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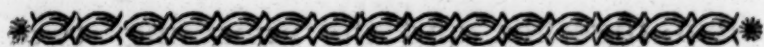
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C H A P. II.

Of the necessary Materials.

SECTION I.

THE length of the fascine commonly used in field-works, is ten feet, and the diameter one foot. They are made as follows: Six small pickets are stuck into the ground, two and two, forming three little crosses; well fastened in the middle with twigs of willow, or birch. On these trestles, or little wooden horses, the branches are laid, and are bound round with withes, from end to end. Six men are employed in making

Plate
26.
Fig.
1.

E 3 . . . a fascine;

a fascine ; two cut the boughs, two gather them together, and the remaining two bind them. These six men may very easily make twelve in an hour. Willow, or birch, is the most proper for this work. The fascines being laid in the direction of the lines which form the parapet, or other parts of the work, are fastened to the ground, and to one another, by means of pickets, three or four feet long, and an inch and half diameter, pointed at one end. This forms a facing, that helps to sustain the parapet, which otherwise would be apt to tumble down by its weight. The fascines are made only eight feet long, for works *en-cremaillere*.

Fig.
2.

SECT. II.

Each fascine requires five of the pickets above-mentioned to fasten it.

SECT.

SECT. III.

If there is a scarcity of wood, fod may be made use of to line the parapet. ^{Fig. 3.} They are cut about four inches thick, and a foot square, and are afterwards divided diagonally, each fod making two.

SECT. IV.

Fraises are made eight feet long, and ^{Fig. 4.} five inches broad, sharp at one end. The beams, or sleepers, of wood, laid along the parapet, are twelve feet long, and ^{Fig. 5.} six square inches thick, to which the fraises are fastened with nails seven inches long. Two men may make twelve fraises in an hour.

S E C T. V.

Fig. 6. Palissades, used in fortifying the ditch, are nine or ten feet long, and six inches broad, pointed at one end; but if a sufficient number of these dimensions cannot be had, smaller may be made use of, provided they are properly intermixed with the large.

S E C T. VI.

Fig. 7. The stakes placed in trous-de-loup, must be six feet long, four or five inches thick, and sharp at one end.

S E C T. VII.

Fig. 8. The beams of chevaux - de - frise, are twelve feet long, and six square inches thick. The fraises which pass through the beams cross-wise, are seven feet

feet long, and four inches broad, placed six inches asunder. Chevaux-de-frise are made use of to close up the entrance of redouts, gate-ways, or other passages. They are likewise sometimes placed along the border of the ditch, or in the bottom of it.

SECT. VIII.

Gabions are of different dimensions. Fig.
9. Those used in field-works are three or four feet high, and two or three feet diameter. In order to make them, some pickets, three or four feet long, are stuck into the ground, in form of a circle of about two or three feet diameter, wattled together with small branches, in the manner of common fences. Being placed near each other, they serve to form embrasures for the guns, and are filled with earth.

There

Fig.
10.

There are also gabions about one foot high, twelve inches diameter at top, and about ten at bottom, which are placed along the top of the parapet, to cover the troops in firing over it.

To make all these different materials, a number of wooden mallets, rammers, hatchets, and bill-hooks for cutting, branches must be provided.



CHAP.

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

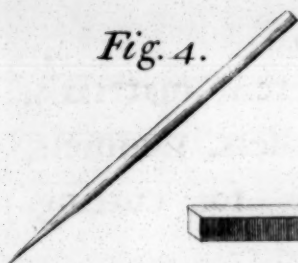


Fig. 5.

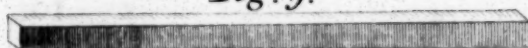


Fig. 6.

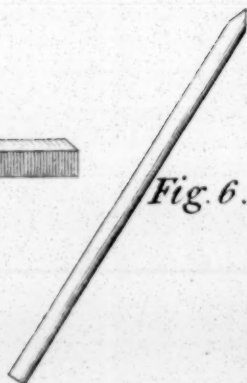


Fig. 7.

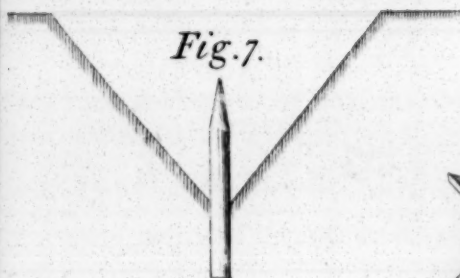


Fig. 8.

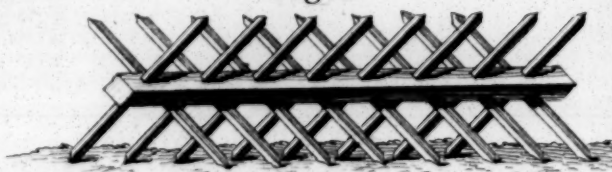


Fig. 9.

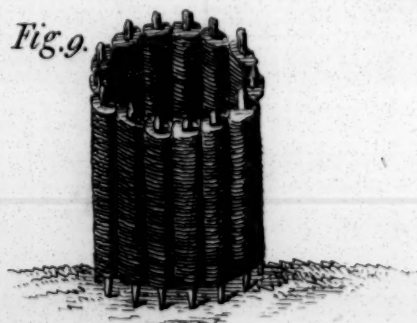


Fig. 10.



THE OPORTUNITY

CHAPTER III

THE OPORTUNITY

SECTION I

THE OPORTUNITY

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C H A P. III.

How to calculate the proper Quantity of each Material.

SECTION I.

WHEN the situation and strength of the detachment appointed to defend a work, have determined its dimensions, the necessary quantity of materials for constructing it is next to be calculated; in regard to which it must be observed,

1st,	To line five paces of the inside of the parapet, it	<i>Fas.</i>
	requires - - - - -	6
2d,	To line five paces of the outside - - - - -	4
3d,	To fascine five paces of the banquette - - - - -	2
4th,	To each embrasure - - - - -	6

SECT.

SECT. II.

By the preceding table, the number of fascines required is easily found. Let us suppose, for example, a redout is to be constructed to contain two hundred and forty men, or one hundred and twenty file; proceed as follows:

	<i>Fas.</i>
1st, To line one hundred and twenty paces of the parapet within-side, allowing six fascines to every five paces, it requires - - - - -	144
2d, To line the out-side, four fascines to every five paces. — N.B. As many, however, are allowed, viz. - - - - -	144
3d, To fascine the banquette, about a fourth of what are allowed for the inside of the parapet	36
4th, In reserve, to supply those that break - - -	30
Total	354

Each fascine requires five pickets. Total 1770.

SECT. III.

The number of palissades that are wanted, is found in the following manner:

FIELD-FORTIFICATION. 61

ner : They are made six inches broad, and planted three inches asunder ; so that every palissade takes up nine inches. The circumference of the work, measuring along the middle of the ditch, must be found in paces, allowing eight palissades to every three paces, which, at the rate of two feet to a pace, is six feet taken up by eight palissades. If the circumference of the work is therefore one hundred and fifty paces, four hundred palissades will be required, allowing eight palissades to every three paces.

SECT. IV.

As to the proper quantity of fraises, they are calculated on the same principle. Each fraise requires eight inches, viz. five for the fraise, and three for the interval between them ; so that three fraises are allowed to one pace, or twenty-four inches. They are so placed, as to hang
over

over the berme, and to reach beyond it. The out-side circumference of the parapet must be first known in paces, and the calculation then made. For example, we will suppose it to be one hundred and sixty-five paces: three fraises are allowed to each; so that there will be required four hundred and ninety-five fraises in all. The same number of nails must be provided, seven inches long. The beams, or sleepers, the fraises are fixed to, are twelve feet long; so that one beam is allowed to eighteen fraises; or, to reckon more readily, a beam to every six paces.

SECT. V.

In order to find with greater ease the proper quantity of materials required in the construction of a work, it is necessary to accustom one's self to take
paces

FIELD-FORTIFICATION. 63

paces about two feet wide, which a very little practice will render habitual. This will save much time and trouble, that must otherwise be employed in measurements and long calculations, &c.



CHAP.



C H A P. IV.

Of the Construction of Works.

W H E N all the lines of a work are traced out upon the ground, viz. the line of the rampart, thickness of the parapet, berme, ditch, and banquette, the workmen then begin to break the ground. In regard to which, the following remarks ought to be attended to.

SECTION I.

Plate 27. A row of workmen *a*, placed along
 Fig. 1. the line marking the berme, fronting the
 work, and a good pace asunder, throw
 the

FIELD-FORTIFICATION. 65

the earth from the ditch, towards the lines tracing out the parapet. — But it will be necessary, first of all, to lay a row of fascines along the inside line of the parapet *b*, fixing them well with small pickets, to prevent the workmen from covering the first traces with earth. There is a second row of workmen *c*, behind the first, upon the line marking the out-side of the ditch, about two paces asunder. They are employed in supplying the first with earth, which these throw towards the work, in order to form the rampart, and parapet, along with what they dig themselves. The traverse, covering the entrance, is not constructed till the rest is completed.

SECT. II.

The ditch must always have a proper slope, called the talus, on both sides, particularly that next the work, as the para-

F

pet

pet would otherwise be very liable to fall down by its weight. For example, when

Fig. 2. the ditch is ten feet wide, and six feet deep, the inward talus must be three feet, and the outward as much. If the ditch is

Fig. 3. twelve feet wide, and six feet deep, the slope is four feet: and when the ditch is fourteen feet wide, and seven feet deep,

Fig. 4. the talus must be four feet and an half.

When the soil is clayey, or stony, the exterior talus may be less than the interior. The corners, or angles, of the ditch are rounded, to give it the more solidity.

SECT. III.

The inside of the parapet must be six feet high, and the banquette one foot and an half; consequently the foldiers are covered four feet and an half, when they stand upon it. The parapet should be always made about a foot higher at the angles than any other part, that the work may

FIELD-FORTIFICATION. 67

may be less exposed to an enfilade from the enemy's cannon.

SECT. IV.

When the inside of the parapet is six feet high, the outside must be only four feet and an half, that the top may slope like the roof of a house, and the enemy be entirely exposed, even on the very edge of the ditch. But when a redout is constructed upon a height, this proportion between the outside and inside of the parapet, need be no longer observed; for then the top must have slope enough, to be able to discover the enemy at the very bottom of the hill.

SECT. V.

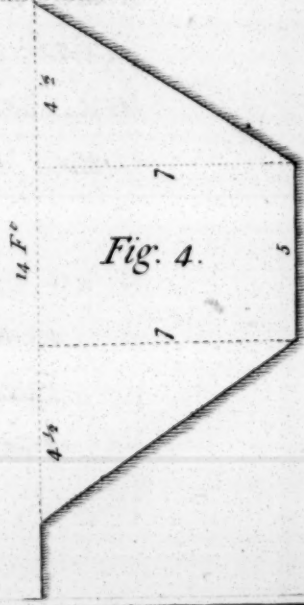
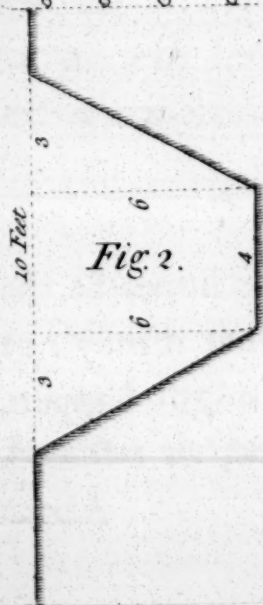
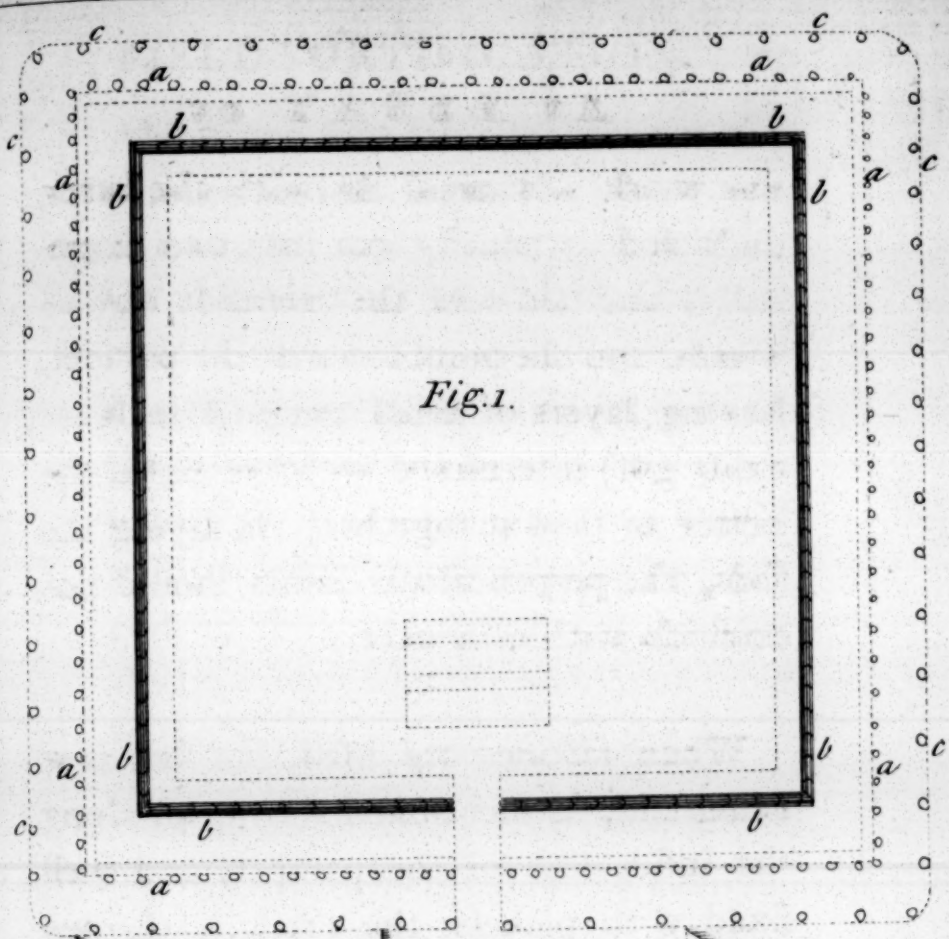
The parapet would be apt to tumble down, if it was not lined either with fascines, or sod, which should form a sort of revetement to support it, according as

the work advances. If with the latter, each fod is usually cut into two diagonally, and laid with the green side downwards, and the point towards the parapet, having layers of small twigs (if such are easily got) intermixed with the earth, the better to bind it together. In laying the fods, the perpendicular joints should not coincide with each other.

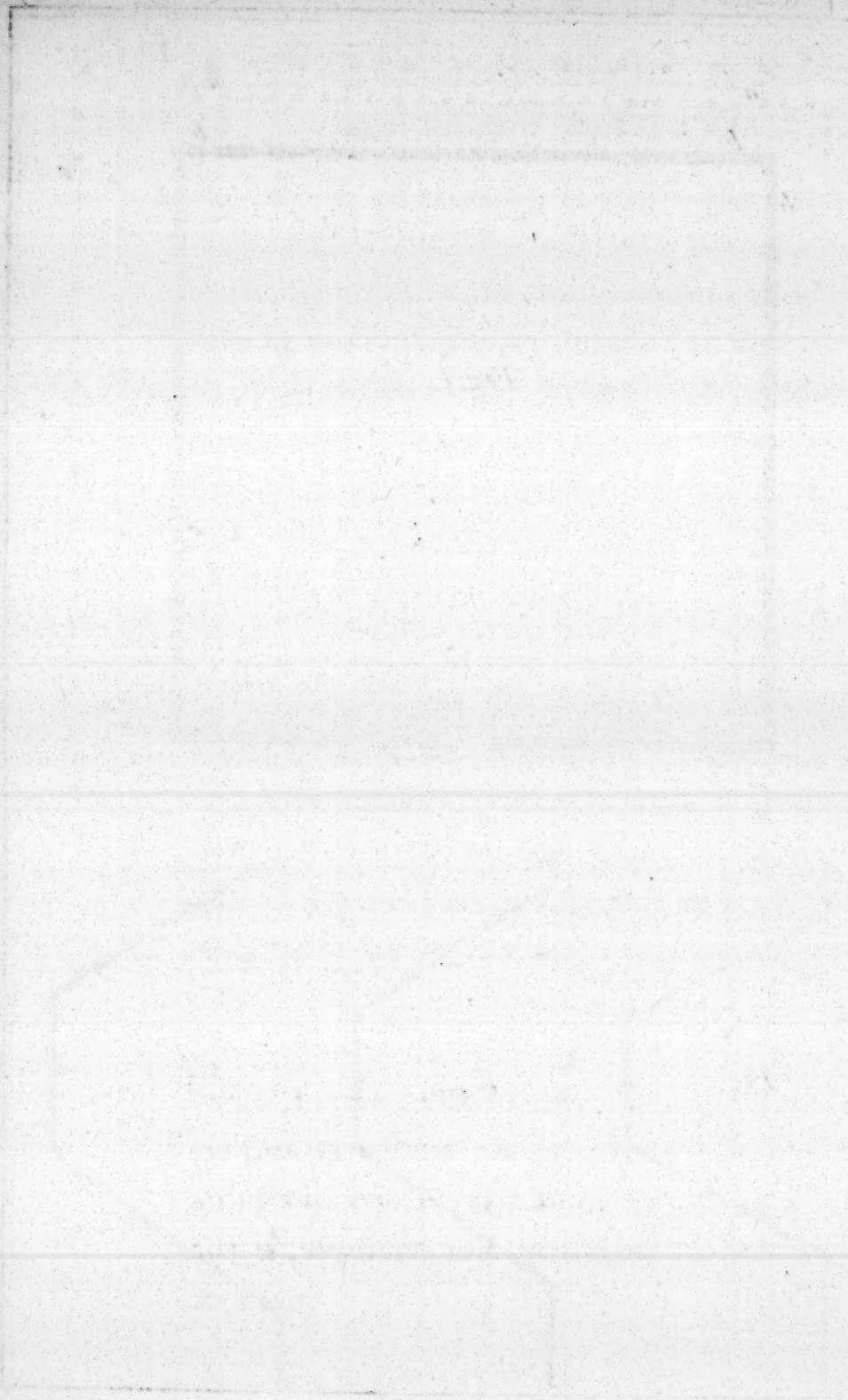
When fascines are used, the first row being laid, as mentioned above, all along the inside line of the parapet, and well fixed with pickets, the earth is thrown against them, laying a second row on the first, and so on, as the breast-work becomes higher. — Observing,

- I. To give a gentle talus, or slope, to the inside of the parapet, that it may not fall, which otherwise might happen, even though it is foded, or fascined.

About



199



FIELD-FORTIFICATION. 69

About one foot talus is sufficient to a parapet six feet high.

II. The fascines must be so laid, that the ends of those in the second row, come not exactly over the ends of those in the first; for if this is not carefully attended to, it is impossible they should resist the weight of earth.— But the ends of those in the first row, must be always covered by the middle of those in the second, — and so of the other rows of fascines.

III. The pickets which fasten the fascines, ought not to be all driven directly downwards, but some obliquely into the parapet, which will make it resist the better.

IV. The exterior side of the parapet, mentioned above to be four feet and an half high, must have a greater talus than the interior. For example, if the

F 3

parapet

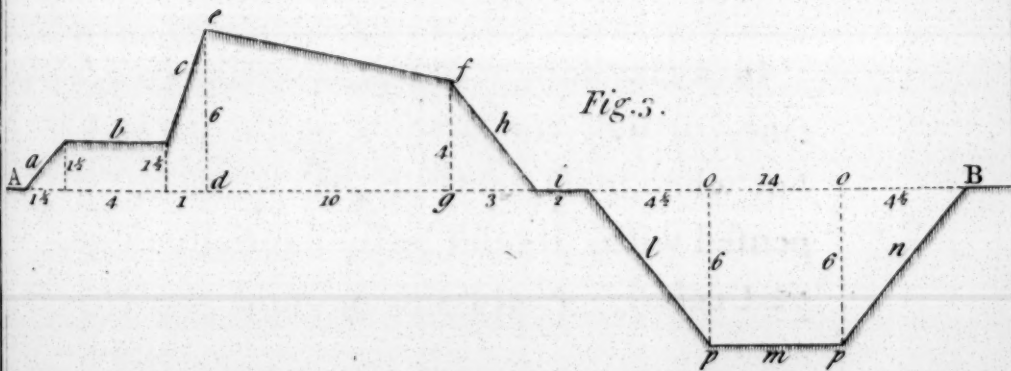
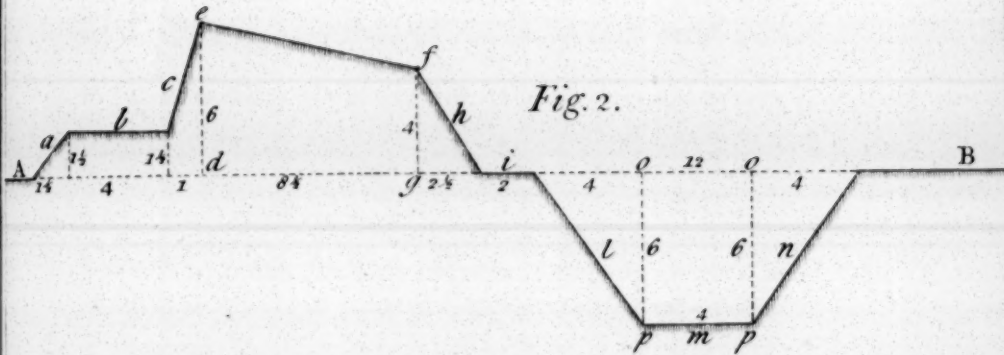
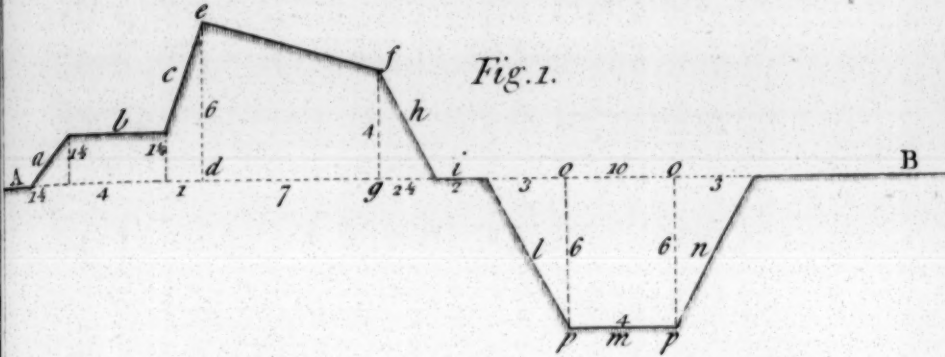
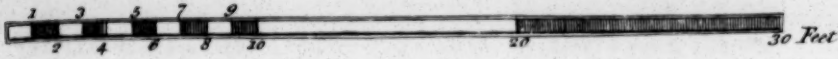
parapet is twelve feet thick, the outward talus should be from two feet and an half to three feet. The banquette must likewise have a slope of one foot. The profiles in the annexed plate will explain this fully, where the proportions are exactly marked.

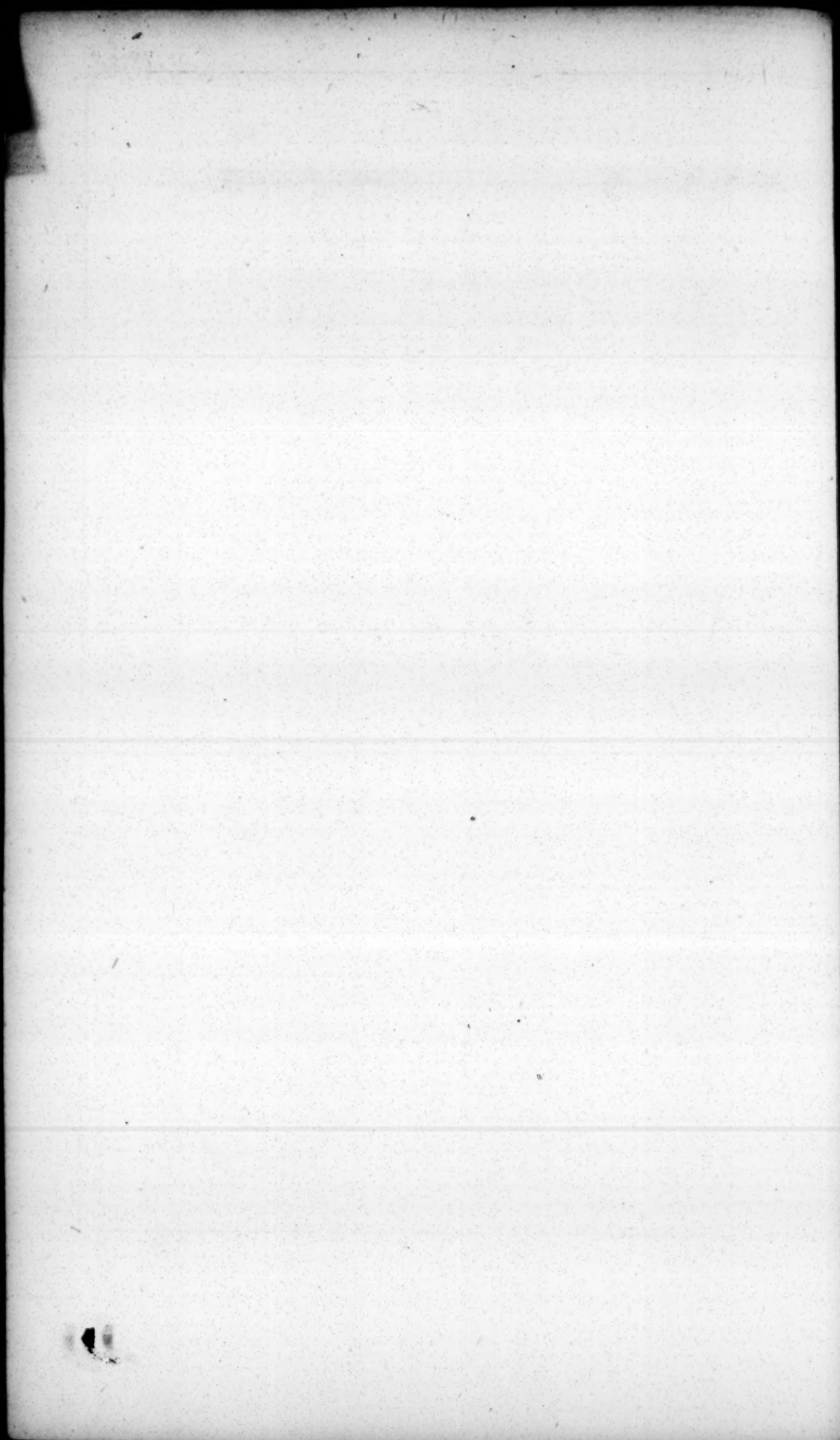
Plate
28.
Fig.
1, 2, 3.

A B,—The horizontal line.		
a,	—Talus of the banquette - - - - -	} Dimensions of the rampart.
b,	—Banquette - - - - -	
c,	—Interior talus of the parapet - - - - -	
d, e,	—Interior height of the parapet - - - - -	
e, f,	—Slope, or talus, of the top of the parapet - - - - -	
f, g,	—Exterior height of the parapet - - - - -	} Dimen. of the ditch.
h,	—Exterior talus of the parapet - - - - -	
i,	—Berme.	
l,	—Interior talus of the ditch - - - - -	
m,	—Breadth of the bottom of the ditch - - - - -	
n,	—Exterior talus of the ditch - - - - -	
o, p,	—Depth of the ditch. - - - - -	

SECT VI.

In a clay soil, it is not necessary to fascine, or fod, the out-side of the parapet; but when loose, or sandy, it cannot be dispensed with. It must be substantially done, particularly where the ground is stony, other-





FIELD-FORTIFICATION. 71

otherwise the garison will suffer a great deal more from the splinters of the stone flying about, occasioned by the enemy's shot, than from the bullets themselves.

S E C T. VII.

The embrasures should likewise be lined. They may be done with fascines, but much better with sod, as not being liable to take fire. They are one foot and an half wide within-side, and from seven to eight feet on the out-side. The part of the parapet which covers the carriage of the gun, called genouilliere, is two feet and an half high, reckoning from the platforms, which are put under the cannon to make them fire the more true. Indeed the size of the piece generally determines the height of the genouilliere. Great care must be taken to make the parapet on each side the embrasures of the proper height, that the artillery-men may work the guns without being too much exposed to the enemy. The

distance between the embrasures is, at least, six paces, that the merlon, or part of the parapet between, may be stronger, and better able to resist the enemy's cannon.

Plate
29.
Fig.
1.

SECT. VIII.

When there is artillery to spare, embrasures may be made in the angles, particularly in square redouts; for in these kind of works, as the angles are the weakest parts, this method will enable the garison to make a much better defense.

When there is a sufficient quantity of beams and planks, platforms are laid under the guns; but in a scarcity of these materials, one strong plank only is put lengthwise under each wheel.

SECT. IX.

When a work is constructed upon a height not commanded by another, there is

is no occasion for embrasures, as the cannon may fire *en-barbette* *. In that case, the platforms are raised proportionably, and this great advantage gained, of being able to give the guns any direction, unconfined by embrasures : but if the enemy can erect counter-batteries on another height, embrasures are then absolutely necessary, that the cannon may be less exposed to being dismounted.

SECT. X.

If a work is to be defended by a numerous garison, and a great deal of artillery, it may be of service to erect some batteries, particularly in the angles, of a higher elevation than the other parts of the work; for which purpose, at these places, a rampart of earth is raised behind ^{Fig. 2.} the parapet, above the ordinary level, to

* When the guns fire over a low parapet, and not thro' embrasures.

place

AN ESSAY ON

place the guns upon, in order the better to command the adjacent country. That the artillery may be got easily up and down, ramps* are made, as expressed in the plate.

SECT. XI.

When the entrance of a work is covered by a traverse within-side, its parapet should not be so thick, nor the ditch so wide, as those of the redout. Eight feet are sufficient for the thickness of the parapet, and of course the ditch of equal breadth, being six feet deep. However, it must be of the same height with the rest of the parapet, to prevent the garison being exposed in the rear. When there is a fleche before the entrance, the gorge should be closed with chevaux-de-frise, and a communication of the same made with the work.

* Sloping communications, or ways of very gentle ascent, leading from the inward area, or lower part of a work, to the rampart, or higher parts of it.

SECT.

SECT. XII.

The entrance of the redout ought likewise to be secured with a good barriere *, which troops may fire through with small-arms, or with two or three chevaux-de-frise ; or the passage may be filled up with a great number of logs of wood, ready to set on fire, should the enemy attempt to force it.

Fig.
3.

SECT. XIII.

The beams to which the fraises are nailed, are laid on the level ground within the parapet, parallel to the exterior side, and about three feet distant from it. Three feet and an half of the fraises remain in the body of the parapet, and the other four feet and an half lean over the

Plate
30.
Fig.
1.

* A kind of open gate, made of cross-bars about seven feet long, and six inches thick.

berme,

berme, inclining a little towards the ditch *ab*. Pieces of wood, about nine feet long, may be likewise laid along the exterior line of the parapet, to which the fraises are nailed, in the same manner as the first, to strengthen the whole.

The fraises being disposed as above directed, the banquette and parapet are then raised, and lined on both sides, as they advance, with fascines. Indeed, when works are fraised, the exterior talus is seldom lined.

S E C T. XIV.

The ditch may be fortified, either with a single or double row of palissades. If with a single row, the palissades are made nine feet long, planted perpendicularly in the center of the ditch, in a narrow trench, dug two feet deep for that purpose. They are placed three inches asunder;

Fig.
2.

Fig. 1.

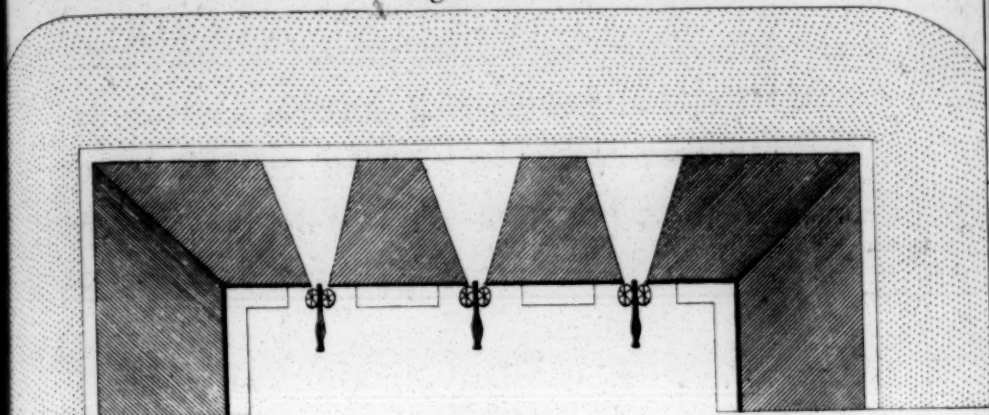


Fig. 2.

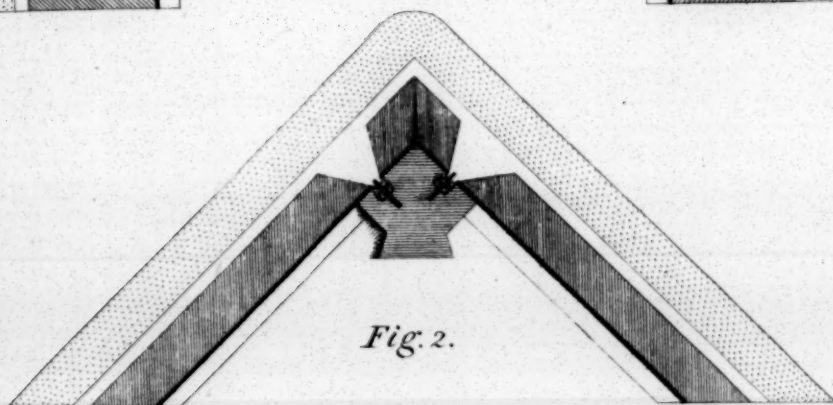
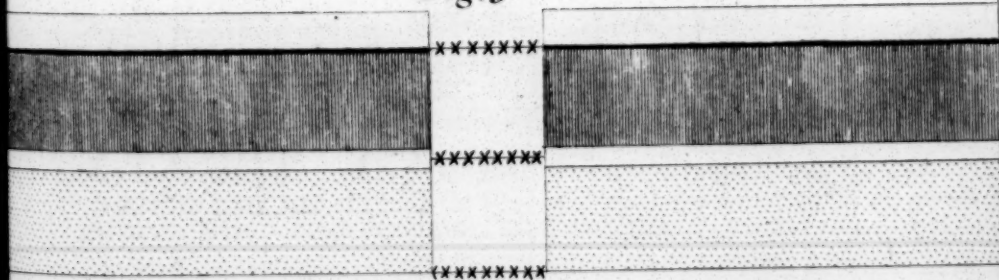
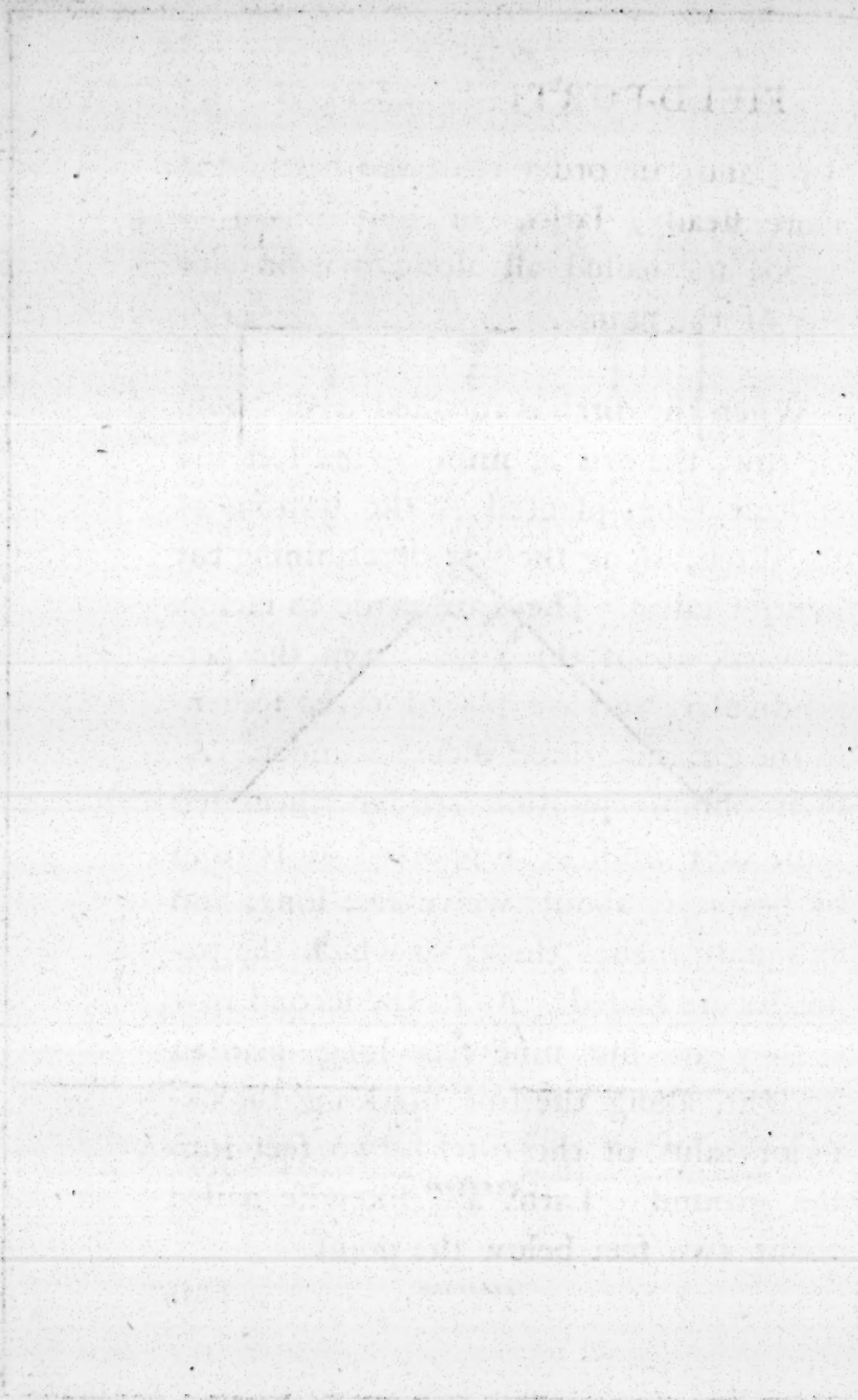


Fig. 3.





FIELD-FORTIFICATION. 77

der ; and, in order to make them the more steady, laths, or split pieces of wood, are nailed all along, within two feet of the point.

When the ditch is fortified with a double row, the first *a*, must be ten feet and an half long, planted in the bottom of the ditch, along the line determining the interior talus. They are made to incline forward, about three feet from the perpendicular, and are placed three feet into the ground, three inches asunder. As their oblique position renders them less firm, they must be supported at bottom by beams *b*, about twelve feet long, and six square inches thick, to which the palissades are nailed. As to the second row *c*, they are but nine feet long, planted upright, along the line marking the exterior talus of the ditch, two feet into the ground. Laths are likewise nailed about two feet below the point.

Fig.
3.

This

This last method of paliffading a work, is much more effectual than the first, as the second row of paliffades are of the greatest utility; for should the enemy have resolution enough to enter the ditch, they can never stand on the slope of the exterior talus; and much less, in that situation, will they be able to cut down the paliffades. It is only requisite they should be so firmly fixed, that to remove them would require infinite labour and trouble, and occasion great loss under the fire of the garison's small-arms. They must likewise never appear above a foot higher than the edge of the ditch, otherwise the enemy would quickly demolish them with their cannon, which might prove of the worst consequence to the garison, should they have address enough to sweep away a whole row at once.

SECT.

FIELD-FORTIFICATION. 79

SECT. XV.

Two rows of palissades are seldom put, but when there is both time sufficient, and great plenty of wood: in general, one may suffice; but it must be remembered, that those of ten feet and an half, placed obliquely, are always to be preferred: however, as even this requires much time and labour, a row may be only planted perpendicularly at the bottom of the ditch, along the line of the exterior talus, which will always afford a very good defense.

SECT. XVI.

There is, however, another method of fortifying a ditch, much more effectual than any already mentioned; and that is, by placing a row of good strong chevaux-de-frise all along the bottom, well fastened

fastened together with cramp-irons. The
Fig. 4. middle beams of the chevaux-de-frise
are twelve feet long, and six square inches thick, as before-mentioned; but the fraises are only six feet, projecting equally on both sides, two rows resting on the ground, and the other two pointing upwards. With such a good defense, the garison can hardly be forced, if they do their duty; for the enemy will be obliged to fill up the ditch with fascines, which can never lie properly, on account of the chevaux-de-frise; so that the passage of the ditch becomes impracticable, and even to attempt it must be attended with considerable loss. This method was much practised during the late war.

S E C T. XVII.

It was the custom formerly, to place a row of chevaux-de-frise quite round a redout,

Fig. 1.

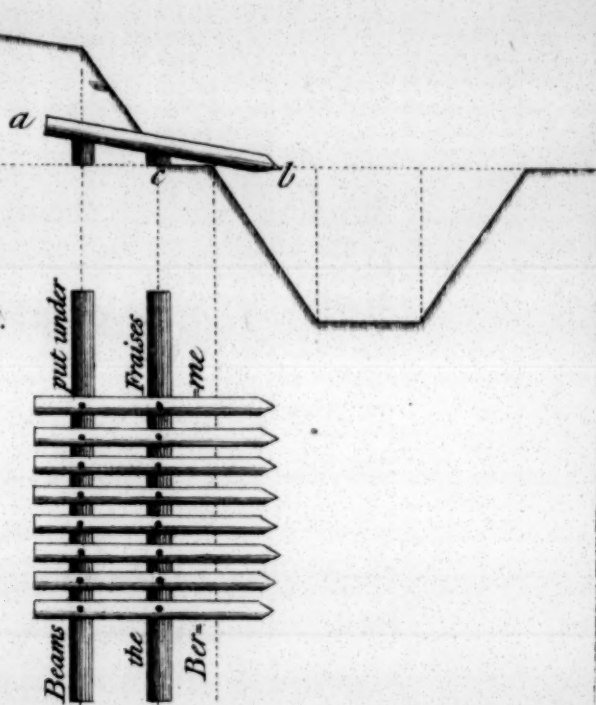


Fig. 2.

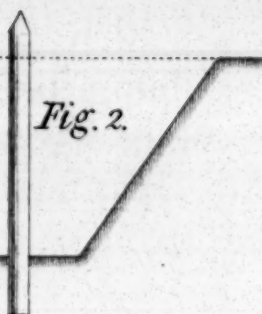


Fig. 3.

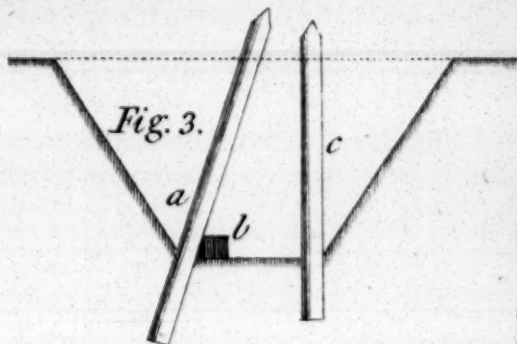


Fig. 4.



DECLARATION

I, the undersigned, do hereby certify that the within and foregoing is a true and correct copy of the original as the same appears from the records of the Court of the said County of [illegible] State of [illegible] this [illegible] day of [illegible] 18[illegible].

Witness my hand and seal of office at the City of [illegible] this [illegible] day of [illegible] 18[illegible].

[illegible signature]

[illegible text]

FIELD-FORTIFICATION. 81

redout, on the plain ground, about six paces from the ditch, made fast together with chains, or cramp-irons: but as the use of cannon is become more general, the shot would very soon demolish what might have taken up several days in constructing.

SECT. XVIII.

A much better method, when wood is near, is, to cut down large trees, and lay them, intire, in form of an abbatis, a few paces from the ditch. The branches must be well entangled into one another, and presented towards the enemy, the trunks being next the work.

SECT. XIX.

Trous-de-loup may be dug round a redout, to obstruct the enemy's approach. They are circular at top, about four feet

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and

and an half diameter, and pointed at bottom, like an inverted cone, or sugar-loaf. Their depth is six feet. A stake six feet long is fixed in their center, driven two feet into the ground, and made sharp at top.
^{31.}
Plate Fig. 1. Two or three rows of them are dug chequer-wise, about six paces from the edge of the ditch, viz. two rows of holes exactly opposite to each other, and a third row in the middle, covering the intervals.

SECT. XX.

When there is time enough to spare, and particularly when it is intended a post should hold out for some considerable space, a guard-house built of large beams and planks is erected within the work, to shelter the garison from the inclemencies of the weather. That it may be less exposed, it should be sunk two or three feet below the surface. Joists are
laid

FIELD-FORTIFICATION. 83

laid along the top, covered with about two feet of earth, to prevent its being pierced by the enemy's grenades. A row of palissades must be planted quite round the guard-house, three paces distant from it, with space enough left between them for the soldiers to fire through. When the garison are forced to quit the parapet, they may make a last effort behind this kind of inclosure, which is therefore shut with a strong barriere, made fast within-side.

SECT. XXI.

The earth to form the banquette, is of course taken from the ditch; but when a redout happens to be constructed on a height, it must be taken from the interior part of the work, which is equally dug up, half a foot or more, in order to make the banquette. If a redout is erected upon a very high hill, with defilès at bot-

tom, and consequently of difficult access, a great deal of trouble may be saved, in giving both less breadth and depth to the ditch than above-mentioned. The additional quantity of earth requisite to give the parapet its proper dimensions, is taken from the inside; and by that means the men are put sooner under cover, as in a trench. In such cases, a banquette is not always necessary. — But the preceding method is only to be followed in very stony heights, where there is not earth sufficient to form the parapet, without scraping it up from the interior surface.

S E C T. XXII.

When a redout is commanded by a height within cannon-shot, that part of the parapet facing the height, must have so much elevation as to cover entirely the troops who line the other parts, and prevent

vent their being seen in reverse, and in flank. The breadth and depth of the ditch must be therefore encreased, to have earth enough for the parapet. In such a case, the banquette must be raised proportionably; and that the soldiers may get readily up, to fire over the parapet, it should consist of two or more steps, which will of course augment its breadth. But if raising the parapet of that part of the work opposed to the enemy, should not effectually cover the troops posted behind the other faces, then traverses must be made, as an additional security. Fig.
2.

S E C T. XXIII.

If a work is only exposed to the fire of small-arms from a neighbouring height, a row of small gabions, filled with earth, must be placed along the top of the parapet, on that side. They are made, as

G 3

before-

before-mentioned, one foot high, twelve inches diameter at top, and about ten at bottom, that the men may easily fire between them.

Fig.
3'

SECT. XXIV.

When all the earth dug out of the ditch cannot be used, it should be scattered about without-side the work, and no heaps left, which might cover the approach of the enemy.

SECT. XXV.

The powder and cartridges must be carefully preserved from contracting any damp, as well as from being set on fire by the enemy's grenades. For this purpose, holes, by way of magazines, are dug within the work, whose sides are lined with planks, to keep the earth from

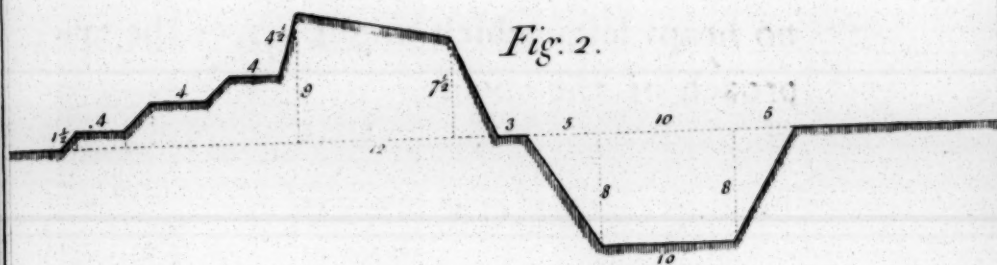
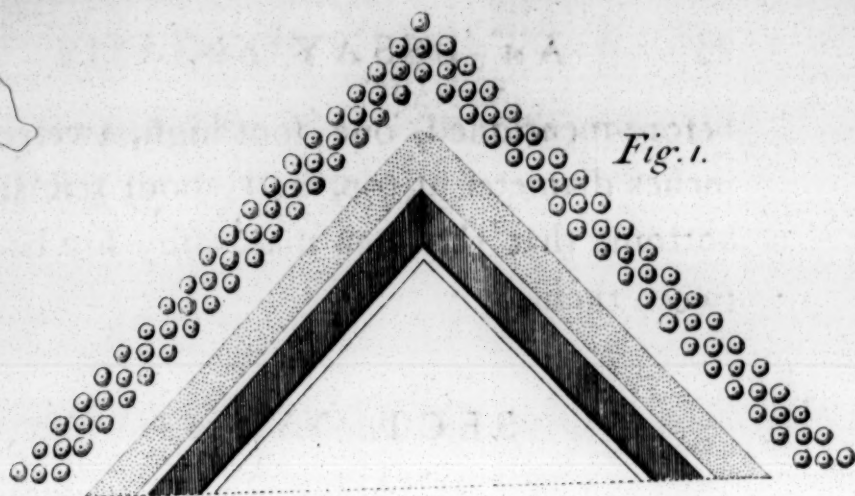
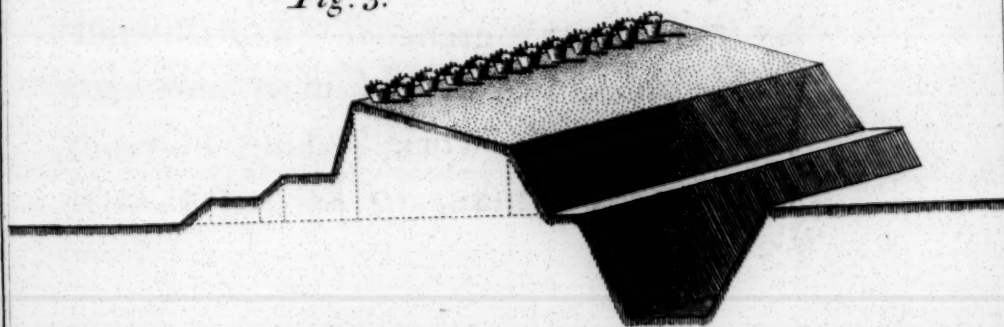


Fig. 3.



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from tumbling in, and covered over with strong pieces of wood.

S E C T. XXVI.

To finish a redout, &c. with expedition, there ought to be exactly twice the number of workmen employed in constructing it, as there are men appointed for its defense. For example, a work to contain two hundred men, requires four hundred workmen. One half of them are set to work as soon as it is traced, the rest are employed the first three hours in making the necessary materials, such as fascines, pickets, palifades, &c. They lay them in several parcels, and afterwards apply them properly. These last two hundred men are divided into two parties, who relieve each other every two hours. They both rest for an hour, before they relieve the two hun-

dred who throw up the earth, that they may work with the more spirit. The two hundred, when relieved, likewise rest an hour; and are then divided into two parties, as the first, in order to make fascines, &c. relieving each other regularly in this manner. A proper number of officers, and non-commissioned officers, must be appointed to every thirty workmen, in order to keep them to their duty.

SECT. XXVII.

Half the number of workmen must have pick-axes, a fourth spades, and a fourth hatchets; so that if there should be one hundred workmen, fifty must have pick-axes, twenty-five spades, and twenty-five hatchets. Along with every hundred workmen there should likewise be ten men carrying axes, and knowing something of a carpenter's business.

SECT.

FIELD-FORTIFICATION. 39

SECT. XXVIII.

The different kinds of materials must be laid regularly in heaps by themselves, as above-mentioned, that they may be ready when wanted, and not scattered about, so as to hinder the workmen. In this manner the palissades and fraises, with as many fascines and pickets as are sufficient to line the out-side of the parapet, must be laid on the edge of the ditch ; and the remainder of the fascines and pickets are carried within the work, to line the inside of the parapet and the banquette.

CHAP.



C H A P. V.

Of fortifying a Church, Church-yard, old Castle, or any other Stone or Brick Building, with the adjoining Out-houses.

AS there may be numberless reasons for fortifying posts of this kind, it would only take up time to enumerate them; we shall therefore content ourselves with observing, that, in general, it is impossible to take too many precautions against an enemy, since the preservation of such posts may not only be of the utmost importance to the good of the service, but, at the same time, furnish an officer with the means of acquiring reputation ;

tation ; and intitles him to the hopes of reward, for having made a good disposition, and vigorous defense. He can, indeed, never be at too much pains to inform himself particularly in every thing relating to this branch of his profession : he should even suppose new obstacles and difficulties occur, and contrive the remedies, that he may be able to act properly when circumstances require it. These posts are so different, either on account of the building, situation, or lying of the ground all around them, that there is no such thing as pretending to establish rules for every particular case ; for what in one may be extremely proper, in another may be very dangerous to practise. In the first place, the number of workmen must be known ; the strength of the detachment ; whether or not the necessary materials are provided, without which nothing can be done ; or if wanting,

ing, where they are to be had; and to be able to give a guess how long the post will take in fortifying. This last circumstance is of the greatest consequence; for if, from the situation of things in general, it is probable that the enemy will advance immediately, only such arrangements must be made as are absolutely necessary, deferring till another opportunity what would take up more time, and occasion much greater trouble. But when there are both workmen and materials sufficient, and time enough to spare, the following rules ought to be observed,

SECTION I.

We shall suppose, for example, that a church-yard is to be put into a proper state of defense: the first thing to be done, is, to examine carefully its natural situation; for should there be any
stone,

stone, or brick, buildings within musket-shot, or if it is commanded by any neighbouring heights, the best disposition will signify nothing ; the post must be always bad.

In the second place, it must be considered, whether there are troops sufficient for its defense : if there are not, all the fortifying in the world can never prevent the enemy making themselves masters of it in a very short time ; and indeed it will be much the same, whether they find the post not at all, or but very weakly, defended ; therefore, in such circumstances, the only thing an officer has to do, is, to confine himself to fortifying the church.

SECT. II.

With regard, however, to the church-yard, the first care must be, to barricade, without exception, all the roads and
avenues

avenues leading to it, by placing in them carts filled with dung, having two wheels taken off; or by cutting down large trees, and leaving them intire in the roads. Sometimes the access may be defended by trous-de-loup, chevaux-de-frise, &c. As to the small narrow paths, they may be blocked up with harrows, laid with the points upwards, and fastened well to the ground with strong stakes; with logs of wood, piled up, and disposed in such a manner as to make it difficult to remove them; with large boughs of trees, entangled into one another; with deep ditches cut a-crofs; and, in short, with every thing else that serves to impede, or encumber the passage. All these obstacles must, however, be within musket-shot of the church-yard, so as to be defended by the fire of small-arms, otherwise the enemy will remove them without the least risk, or any possibility of being prevented.

S E C T.

SECT. III.

Both the great and small gates must be well barricaded with beams, or logs of wood, and loop-holes pierced, about seven or eight feet from the ground. They are cut at this height, in order to prevent the enemy from making use of them against the garison. Scaffolds, such as masons use, are erected behind the gates within-side on which the soldiers stand, when they defend them. Loop-holes must be also made at the bottom of the gate, almost even with the ground; and a ditch three feet and an half deep, dug just behind, scattering the earth towards the rear. The men are posted in the ditch, to fire through the lower loop-holes, which are of great service in keeping the enemy from approaching the gate, and perhaps setting fire to it, which,
by

by stooping, and running up, they might very easily effect. Should there be a scarcity of wood, earth may be thrown up against the gate: in that case, loop-holes cannot be made at bottom.

SECT. IV.

If the wall of the church-yard should be very high, and plenty of wood can be got, scaffolding ought to be erected all along the inside, or at least at certain distances, which the soldiers mount by means of planks, with pieces of lath nailed a-cross, in form of a ladder. Loop-holes about eight inches long are pierced in the wall, seven feet from the ground, by which a good defense may be made, and the enemy greatly incommoded, as the situation of the garison so much commands them when they make an attack. There may be also loop-holes pierced at
the

FIELD-FORTIFICATION. 97

the bottom of the wall, and a ditch made behind, as mentioned in regard to the gates, which intirely exposes the enemy, when even within a few paces of the church-yard. .

SECT. V.

When the wall happens to be very high, and wood for scaffolding not to be procured, the upper part of it should be broken down, and a banquette of sufficient height made with the rubbish. But on the other hand, when the wall is very low, a ditch must be dug behind it, deep enough to cover the men breast-high.

SECT. VI.

A ditch is made very near the bottom of the wall, on the out-side, but so as

H

not

not to affect the foundation, about twelve feet wide, and four feet deep, pointed at bottom, that the enemy may have no footing. The earth taken out, is scattered about, and no little heaps left, which might conceal their approach. When trees furround the church-yard, or are near at hand, the post may be still farther strengthened, by laying them, branches and all, along the bottom of the pointed ditch.

SECT. VII.

If there should be any thatched houses in the neighbourhood, they must be uncovered immediately, and the straw burnt. If they are even covered with tiles, it is likewise necessary to unroof them, to prevent the enemy taking possession of them and firing from the garrets, which, overlooking the church-yard, would soon render

render it too hot for the troops to remain. The walls even of all the houses within gun-shot, ought to be demolished, that the enemy may not conceal themselves behind them, and incommode the garison by their fire. In short, every possible means must be used to discover the enemy, on whatever side they may make their approach. All the trees and hedges of the neighbouring gardens should be cut down, and thrown, as before-mentioned, into the pointed ditch on the outside of the wall : and on the side where an attack seems the most probable, the obstacles must be encreased, by digging trous-de-loup, and even constructing *sou-gasses*, if materials can be got.

SECT. VIII.

When all these precautions are taken, a garison who do their duty steadily, will

H 2

not

not easily be forced without cannon ; but if the enemy bring artillery, and make a breach in the wall in order to an assault, it is even necessary to endeavour defending the breach, (particularly when the post must be held out to the last) by filling it with logs of wood, and setting them on fire by some of the volunteers. If there are any trees in the church-yard, they may be likewise cut down, and thrown intire into the breach. All this must so much embarrass the enemy, that their fire will be intirely thrown away, and they obliged to begin the attack anew. But if they are determined to carry their point, the wall must be at last abandoned, though indeed not till the very utmost extremity, and a retreat made to the church, where every particular person is supposed to know his post beforehand.

S E C T.

S E C T. IX.

The first thing to be thought of in fortifying a church, is, to prevent the enemy from being able to force the gates; they must therefore be properly secured by a work formed of palissades, called a tambour. In order to construct it, pieces of wood ten feet long, and six inches thick, must be provided, planted close together, and driven three feet into the ground, so that, when finished, it may have the appearance of a square redout cut in two. An opening *a*, is left in each flank, for the troops to have a free passage to the church, when they abandon the wall. Loop-holes are pierced in the tambour, six feet from the ground, and three feet asunder, about eight inches long, two inches wide, within, and six without. A scaffold is

Plate
32.
Fig.
1.

H 3

next

next erected within-side, two feet high, for the foldiers to stand on; or a banquette may be raised of the same height, made of earth taken from the inside of the tambour. Immediately above this scaffold, or banquette, another row of
 Fig. 2. loop-holes are pierced, in the intervals of those of the upper row: and in this manner the three sides of the tambour have each a double row of loop-holes.

If wood cannot be got of the thickness above-mentioned, thinner pieces may be used; but then the deficiency must be made good by nailing planks within-side, to prevent the enemy's shot coming through, beginning to line it from the bottom. A pointed ditch is next made, two paces from the tambour, scattering the earth all around. To secure the troops against the enemy's grenades, it would be of great service to cover the
 top

FIELD-FORTIFICATION. 103

top of the tambour, by laying beams, or joists, horizontally over it, supported by others that stand perpendicular. On the joists, planks are to be laid, and above them about two feet thickness of earth, taken from the pointed ditch. Tambours constructed in this manner, are extremely useful, serving both to defend the entrance into the church, and to furnish a cross, or flanking, fire, for the parts of the building on the right and left of it. But they must be occupied properly with troops, before the church-yard wall is abandoned, to cover the retreat of the rest towards the church.

These kind of works may be likewise constructed before the gates of the church-yard, that the wall may be defended by a cross-fire; only with this difference, that the latter has oblique flanks, with no openings in them. The plate explains this fully. Plate
33.

H 4

SECT.

SECT. X.

An opening about three feet square, two feet from the ground, is cut in the gate of the church, by which only one man can pass at a time. It is covered with a little door, made of planks, bolted within-side ; and as the other part of the gate is strongly barricaded, will be the only passage into the church ; so that if the enemy were even masters of the tambour, they would not dare to approach the gate, being pierced with loop-holes.

SECT. XI.

Should the church-windows be so high as to make it impossible for the enemy to fire in upon the garison, scaffolding must then be erected in the inside, for the soldiers

FIELD-FORTIFICATION. 105

diers to stand upon, to fire into the church-yard; but if they happen to be so low as to enable the enemy to see, and fire into the church, they ought then to be immediately closed up with beams, and planks, to about eight feet from the ground, and scaffolding of a proper height erected behind, for the use of the garrison.

SECT. XII.

Loop-holes must likewise be pierced into the walls of the church, all round, if not too thick; and if there should happen to be galleries, they may serve very well instead of scaffolds, and the loop-holes must be opened accordingly. There should be also another row of loop-holes, within seven feet of the ground, and the seats and benches of the church used by the troops by way of banquette; but
when

when the walls are too thick, the loop-holes must be pierced between the pillars, where they are generally thinner.

Loop-holes are commonly made of the proportions already mentioned, that is, eight inches long, two inches wide within, and six without.

SECT. XIII.

The principal thing to be considered in all these kind of works, is, to obtain a cross-fire. As churches, for the most part, are built in form of a cross, this advantage is at once gained; for there is of course a cross-fire from the loop-holes: but when the form of the principal building is such, as not to answer the purpose, then it is to be procured by making loop-holes in the porches, vestry, and other smaller projecting parts of the church.

Fig. 1.

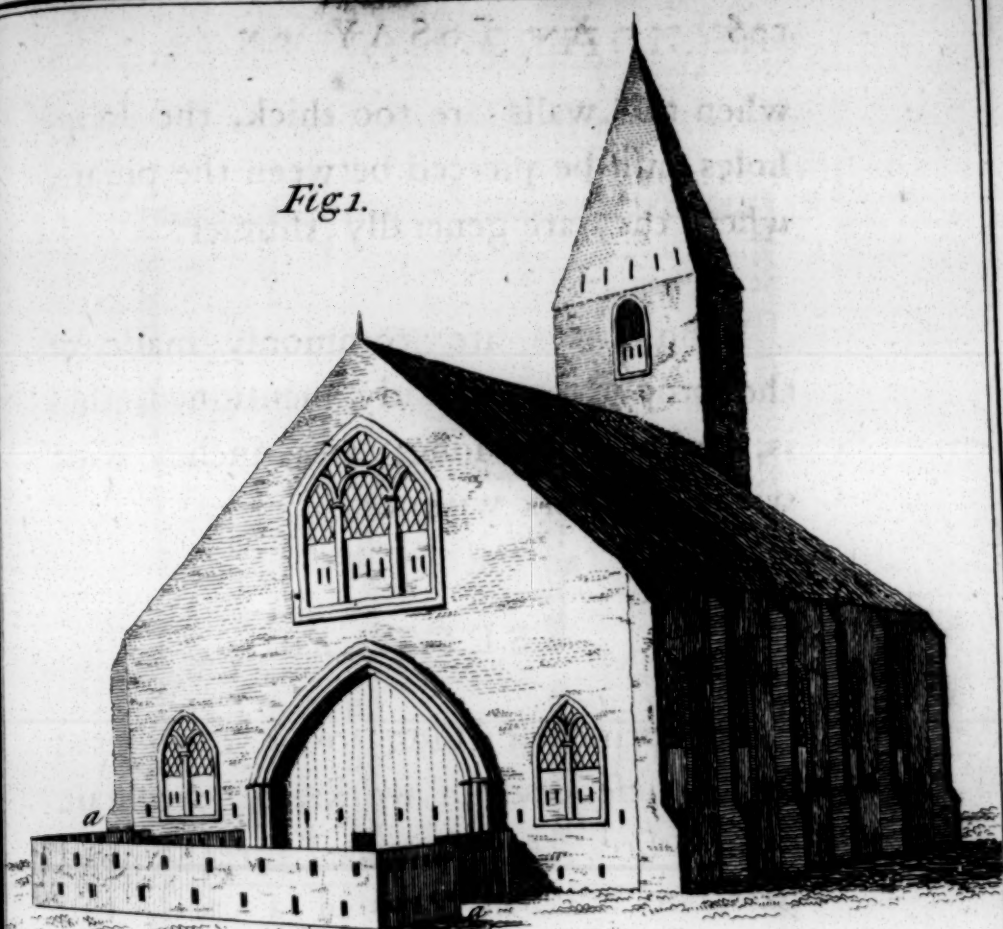
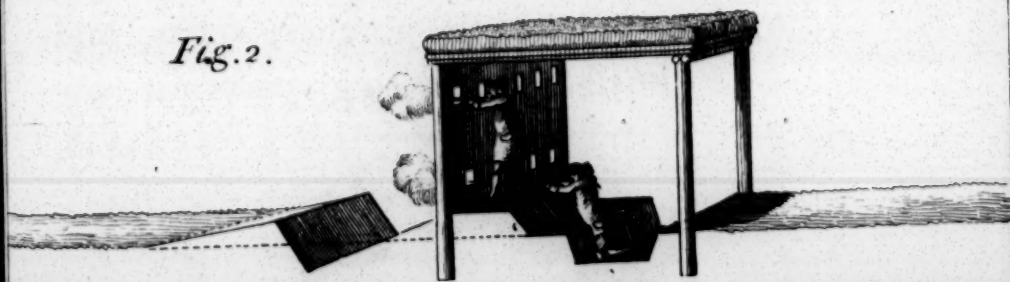
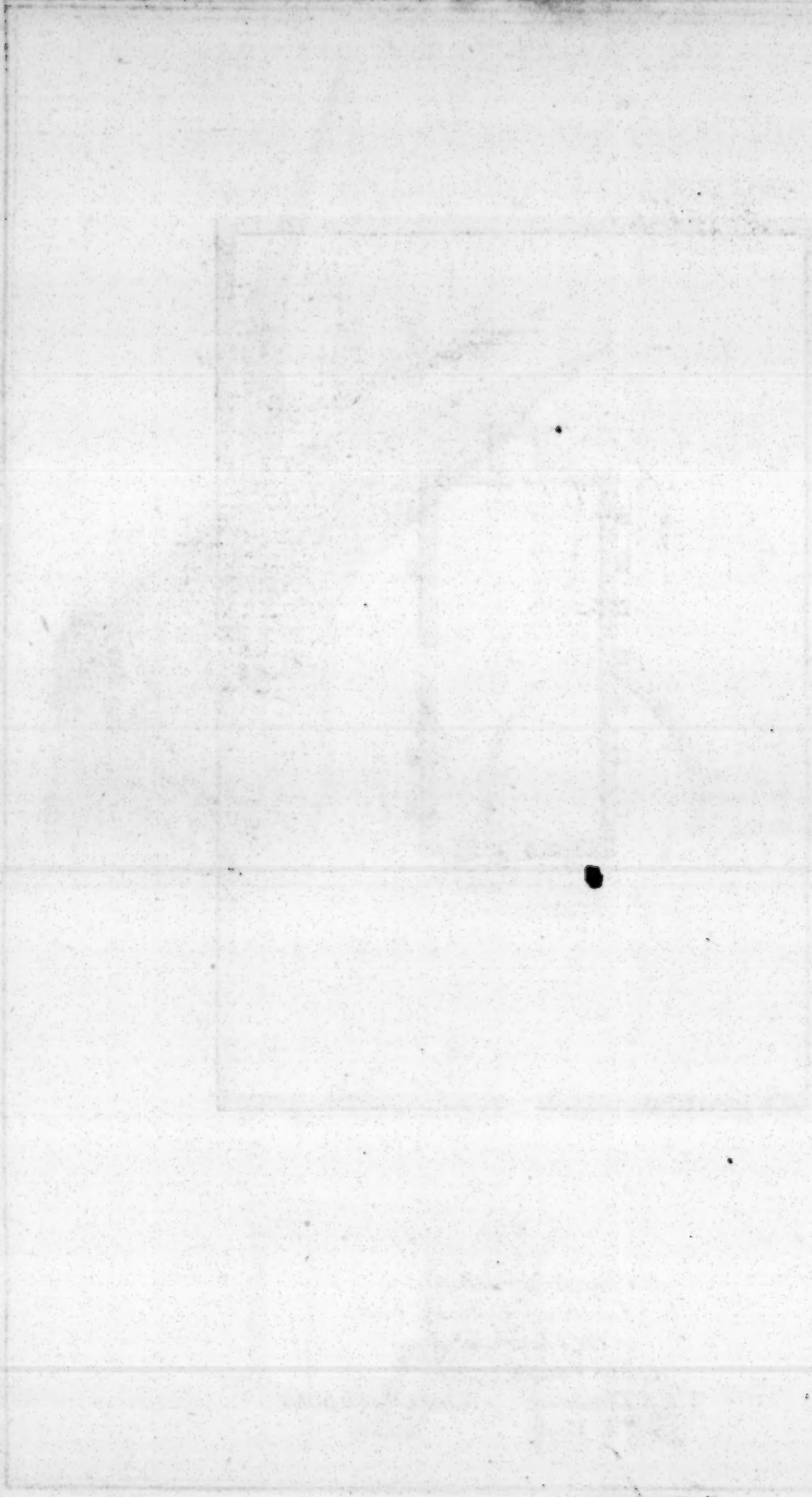


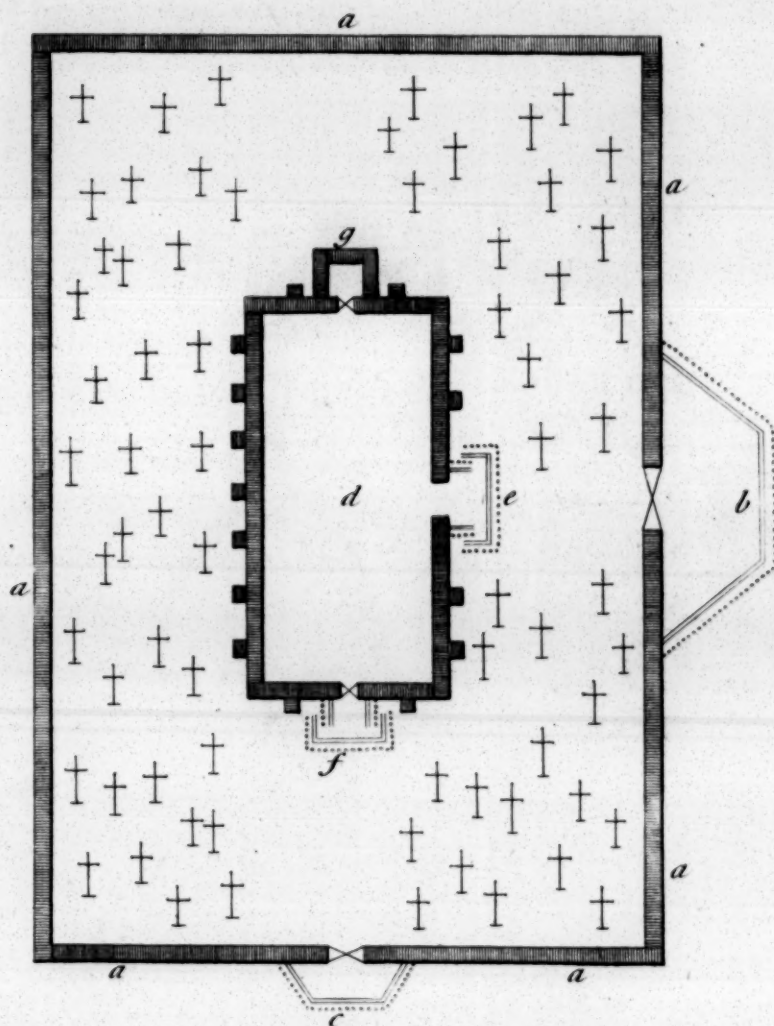
Fig. 2.



T. Jefferys sculp.

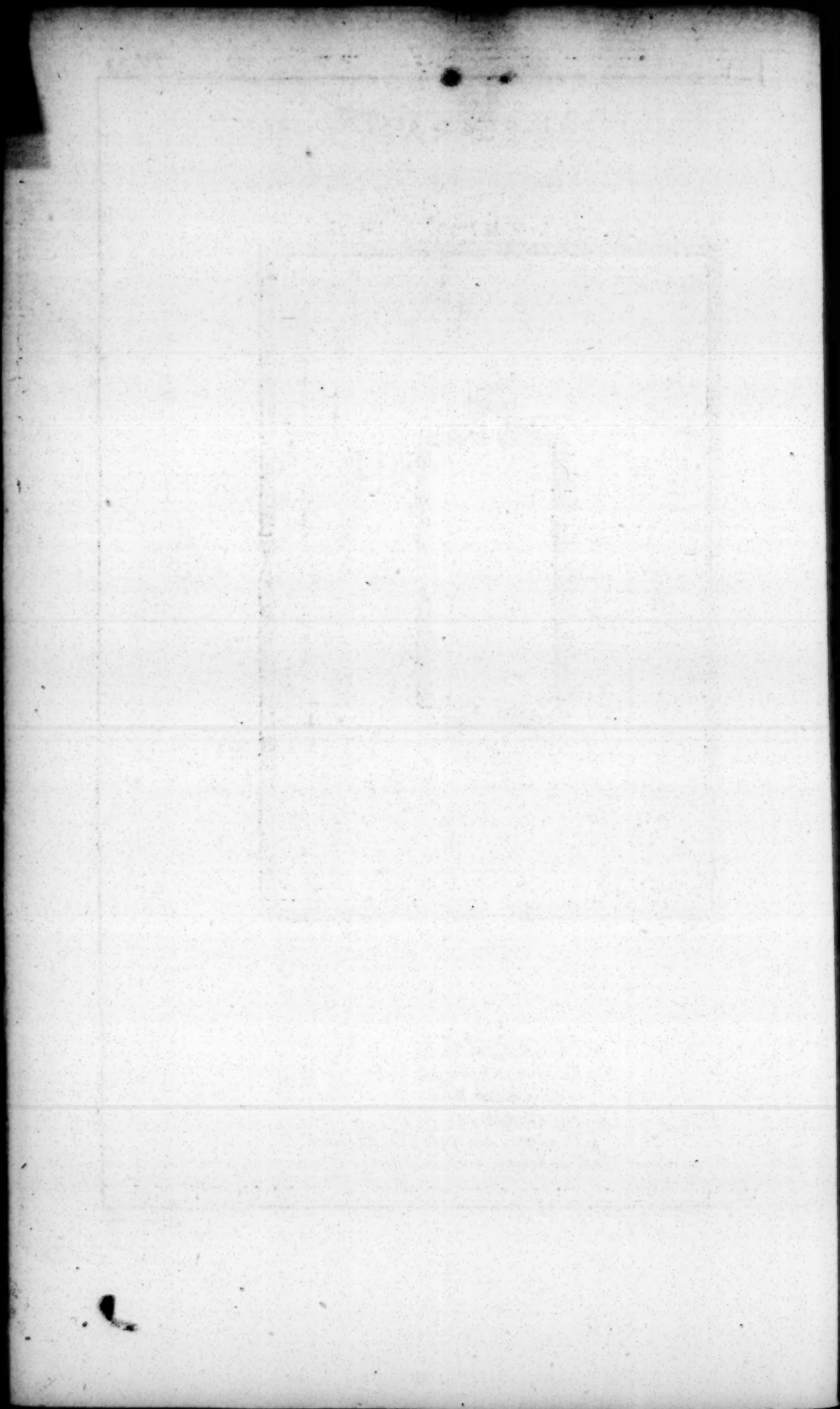
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- a. Church Yard Wall.*
b. c. Tambours before the Gates
of the Church Yard.
d. The Church
e. f. Tambours before the Church Gates.
g. The Vestry.

2



FIELD-FORTIFICATION. 107

church. If there are none such, tambours must be constructed on every side.

SECT. XIV.

It is necessary soldiers should be posted in the garret, or upper part of the church, that the enemy may be discovered even at a distance, and consequently fired upon. The windows of the steeple ought at the same time to be barricaded, and loop-holes made. The very pavement of the church should be lifted, and the bricks and stones carried to the top of the wall, in order to gall the enemy, when they approach too near.

SECT. XV.

Some large hogheads, or tubs, filled with water, must be provided, ready to extinguish fire, if the enemy should attempt to burn the church.

SECT.

SECT. XVI.

When an old castle, country-seat, or any other building of that kind, is to be fortified, with the adjoining out-houses, such as stables, barns, brew-house, &c. the number of troops that can be furnished for its defense must be first known. If this number is considerable, the principal building, and out-houses, together with the wall which furrounds them, should be put into a state of defense: but if there is only an handful of men, the old castle alone is all that must be attempted to be maintained.

SECT. XVII.

After loop-holes are pierced in the walls, round the inner yard, banquettes of earth of a proper height are thrown up,
for

for the foldiers to ftand upon, as mentioned in regard to church-yard walls. The garifon is then fo difpofed, that a reserve remains in the inner-yard, ready to affift where wanted.

SECT. XVIII.

In fortifying fuch pofts, the principal thing to be attended to, will be, to obtain a cros-fire, which is eafily procured when the walls happen to flank each other, as loop-holes are only wanting: but when that is not the cafe, fleches, or tambours, muft be conftituted, with oblique flanks, particularly to defend the entrance. All the roads the enemy can approach by, muft be well barricaded, in the manner above-mentioned. The barns, ftables, and other out-houfes, being of mafonry, muft have loop-holes made in the walls, on the fide facing the country,

try, as well as that next the inner-yard, to be able to fire upon the enemy when either of the passages are forced. When there is time enough to spare, every obstacle that can be imagined should be made use of; and if there is plenty of powder, even fougasses should be disposed before the weakest parts, in order to blow up the enemy when they make an assault.

Fire must be carefully guarded against; and on that account, all the combustible stuff, roofs of thatched houses, dry branches, wood, &c. ought to be immediately collected and burnt.

SECT. XIX.

If the enemy should bring cannon to batter in-breach the wall of the inner-yard, it must, notwithstanding, be defended,

FIELD-FORTIFICATION. 117

fended, while there can be wood enough got to fill up the breach; but when no longer defensible, either because it is too large, or that the enemy are preparing to storm it with a force superior to the garrison, and which they despair of being able to resist, then the out-houses and inner-yard must be abandoned, and a retreat made to the old castle, where every particular person is supposed to know beforehand the post that is assigned him. In this critical juncture, care should be taken to have troops placed both in the second story, and garrets, to cover the retreat of those who lined the walls.

SECT. XX.

In fortifying old castles of this kind, it must always be observed, that a thin wall of brick is preferable to one of stone, as a ball easily pierces the former, leaving

leaving only a small hole ; whereas in the latter, large openings are made, as well as great mischief done by the splinters flying about.

S E C T. XXI.

To avoid being exposed to fire, about a foot thick of dung is laid over the floors of the garrets, and large tubs, filled with water, provided, to be ready, should such an accident happen. The gate, and, in short, all the other entrances to the house, must be strongly barricaded, but so as they may be opened, when circumstances require it. They are pierced with loop-holes, and troops posted behind them.

S E C T. XXII.

The windows of the first, or ground-floor must be closed up with planks, and
beams,

FIELD-FORTIFICATION. 113

beams, eight feet from the ground, and those lower, with bricks, leaving, however, openings to fire through. The wood and bricks of the partition walls may be used, if no other can be had. The loop-holes made in the windows are about seven feet from the ground, and three feet asunder. A scaffold should be erected, if necessary, or the chairs, &c. may be made use of.

SECT. XXIII.

In case it is found requisite, the boards of the floor may be taken up, and loop-holes pierced in the wall, just above the level of the ground : however, a ditch six feet wide, and three feet and an half deep, must be then made along the inside, for the soldiers to occupy. A ditch, pointed at bottom, may be likewise dug, on the out-side, to prevent the enemy approaching, quite along the foot of the
I wall.

wall. As the angles, or corners, of the house are always of course the weakest, there ought to be in these parts a double, or even a triple row of loop-holes. As to the reserve, they are stationed in the vestibule, or hall.

SECT. XXIV.

Loop-holes must also be made in the other stories; but one row is sufficient, about three feet and an half from the floor. If there should be any towers, or other projecting parts, which might furnish a cross-fire, the advantage ought to be taken of piercing them with three rows of loop-holes, and erecting proper scaffolding, which may enable the garison to make a very good defense. The tiles of the roof may be here and there removed, in order to fire upon the enemy; and if there are any galleries which communicate from one part of the building
to

to another, they may be rendered of some service, by lining the balustrade with sacks filled with earth, and placing troops behind them.

S E C T. XXV.

If the building has an extensive front, with only one stair-case leading to the second-floor, the ceiling of the first, or ground floor must be opened at each end, that communications may be made between the two floors, by means of ladders, in case there should not be sufficient time to construct stairs. In this manner the troops in the different stories will be the better able to assist each other mutually, and those in the first may retreat to the second, when forced to quit their post.

SECT. XXVI.

If the post is of such consequence as that it must be defended to the last extremity, when the enemy bring up artillery, and it is perceived where they intend to make a breach ; before they render it practicable, a good quantity of large beams and planks, &c. must be collected, with which a retrenchment, or small work in form of a re-entering angle, is constructed, behind the part battered in-breach, where troops are posted, to receive the enemy when they give the assault.

SECT. XXVII.

If the enemy, notwithstanding all these precautions, should make themselves masters of the first story, those who defended it retire to the second, where still some
resistance

FIELD-FORTIFICATION. 117

resistance may be made; such as defending the stair-case, opening the floor in different parts, and firing down. This, however, can be of no long duration; for the enemy being masters of the under-part of the building, may easily set fire to it, if the garison refuse to capitulate.

The plate contains an exact plan of such a post; and the requisite materials of every kind being supposed at hand, it is to be fortified in the following manner:

The gate-way *a*, between the barns and brew-house, is covered by a small work of earth *b*, whose parapet is twelve feet thick. As this place, on account of the rising of the ground, is the most likely for the enemy to make an attack, four-gasses *c*, are made in front. The entrance

between the barns and stables *d*, may be likewise covered by a tambour *e*; so that by this means two sides are furnished with a cross-fire. As the ground is low before this last work, trous-de-loup *f*, are dug in its front. All the doors *g*, of the barns are strongly barricaded, and covered on the out-side with ditches *h*, pointed at bottom. As the kitchen-garden *i*, is inclosed with hedges *l*, they are all cut down, that the view may be uninterrupted. The wall *m*, in which there is a door to the garden, is pierced with loop-holes, scaffolding being erected behind it, and the door well barricaded. The fruit-garden *n*, inclosed next the inner-yard with a wall *o*, must be also defended, by making a row of loop-holes; and the back-part, which is only surrounded by a quickset-hedge *p*, has earth thrown up against it in form of a breast-work *q*, and troops posted to defend it.

These

FIELD-FORTIFICATION. 119

These lines are flanked by the garden-house *r*, the porter's-lodge, and the work *b*. The door *s*, is barricaded, and loop-holes pierced in the wall on each side. It is unnecessary to cover this with a fleche, or tambour, as it can only be approached by a narrow dyke, or causeway, laid over the morassy ground, which may be cut in different places *t*, and the sluice shut; so that the brook *u*, will soon overflow the meadows behind the fruit-garden. All the out-houses, viz. barns, stables, &c. must be supplied with loop-holes, and scaffolding erected within-side, as before-mentioned.

The chateau, which is supposed to have two wings, is inclosed in front by a wall *v*, which has also loop-holes. The great gate of the court-yard is covered by a tambour *w*, in order to protect the retreat of the garison, when obliged to

abandon the wall and out-houses, &c. But it will be absolutely necessary to cover this work over-head with planks and earth; for as the enemy will immediately occupy the porter's-lodge and stables the moment they are evacuated, it would otherwise be impossible the troops could maintain themselves there, against the fire from the upper parts of those buildings.

The three entrances to the house *x, y, z*, are barricaded; and, upon the whole, the post must be so strengthened by piercing loop-holes in every convenient part, that a cross-fire is obtained on all sides. At the same time, it must be remembered, to destroy the trees and hedges of the park *δ*, to prevent the enemy advancing under cover.

S E C T.

S E C T. XXVIII.

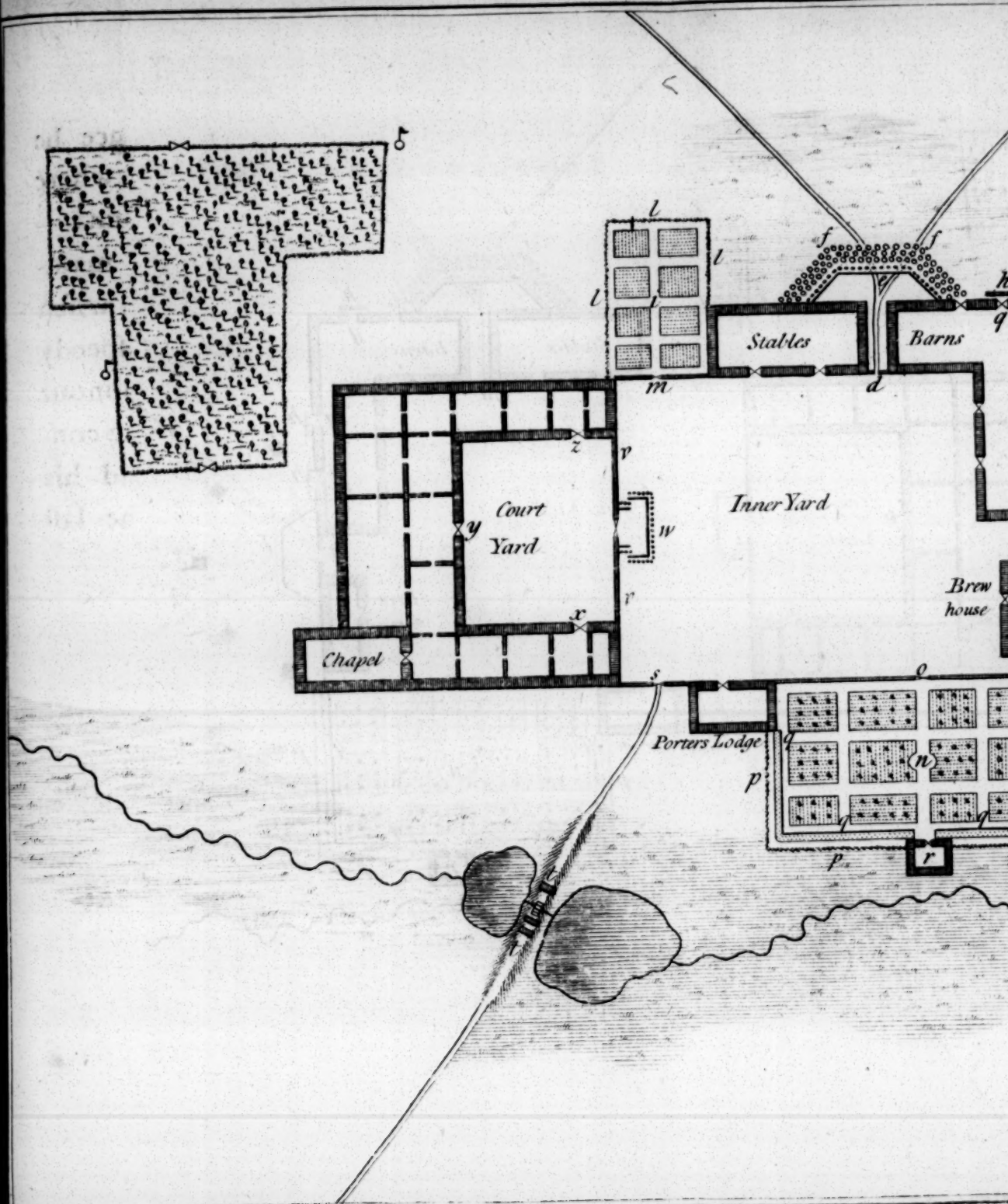
On all occasions of this fort, it is necessary to be as frugal as possible of the powder, and never to fire upon the enemy till it can be done with effect; for as soon as the ammunition is expended, the garison must submit to whatever laws the enemy please to impose. The officer who commands the detachment ought likewise to be careful that his people are provided with provisions for some days, that he may not be reduced by famine to accept of dishonourable terms.

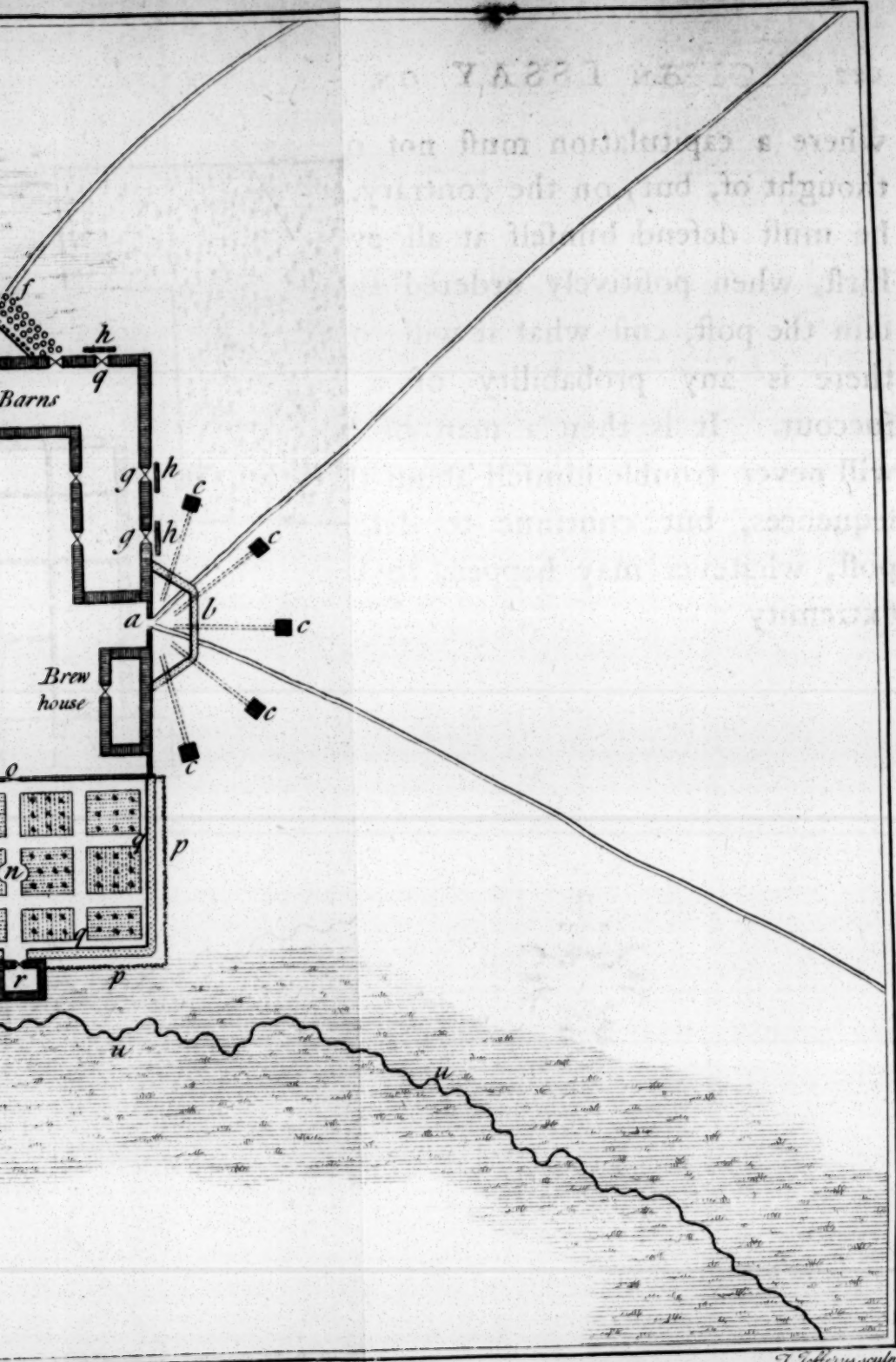
S E C T. XXIX.

Posts of this kind are never intended to hold out a formal siege; when the enemy bring artillery, the affair is generally very soon decided. There are nevertheless two situations which an officer may be in,
where

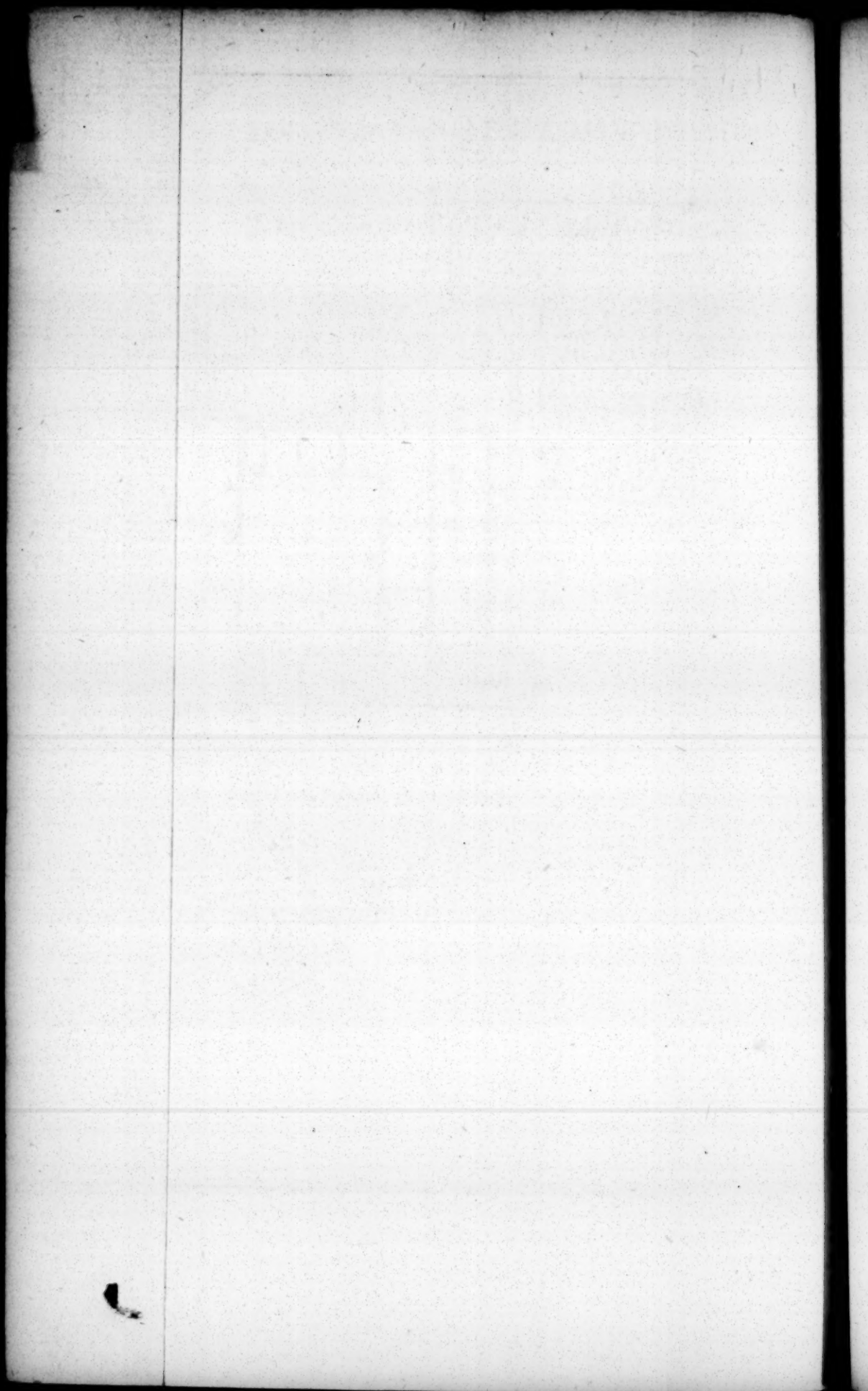
where a capitulation must not once be thought of, but, on the contrary, where he must defend himself at all events.— First, when positively ordered to maintain the post, cost what it will; or when there is any probability of a speedy succour. It is then a man of honour will never trouble himself about the consequences, but continue to defend his post, whatever may happen, to the last extremity







J. Joffers sculp





C H A P. VI.

Scheme for fortifying a Village.

VILLAGES are fortified for different reasons : when not too far from camp, they keep the enemy's irregulars at a distance ; and upon a day of action, serve to cover the advanced posts, or perhaps one of the wings of the army. When the troops are in cantonment, or in winter-quarters, villages put into a state of defense, are of use to prevent surprises, particularly those which are by their situation most exposed, as being nearest the enemy. But, in short, whatever may be the end proposed by fortifying them, the following rules must be observed.

SECT.

S E C T. I.

The country all around must be thoroughly examined and reconnoitred: whether the enemy can penetrate unperceived, under cover of any wood: whether or not the village is commanded by heights: whether the communication to it is easy or difficult: whether a brook runs through it, or on one side: the nature of the banks: whether making it over-flow, would incommode the enemy: how the garison may be most easily relieved; and in what manner a good retreat may be effected, when necessary. All these points ought to be well considered before-hand, and every advantage taken that can result from a perfect knowledge of the ground. Very often, for example, a deep and rugged *ravine*, a rivulet with steep banks and of difficult access, an inundation which may be formed, an impassable morass, a flat ground intersected

FIELD-FORTIFICATION. 125

intersected with ditches, and many other natural advantages, cover a post much more effectually than any thing in the power of art to add.

SECT. II.

When the houses of a village are built of stone or brick, and the roofs tiled, so as to occasion no apprehensions from fire, the outer-most ones, or in general those next the country, should be loop holed, particularly where the roads enter. But when the houses are only built of wood, with thatched roofs, it signifies nothing attempting to make use of them; and in this case, recourse must be had to works of earth. In the construction of these, the obtaining a cross-fire is the principal thing to be regarded, and also that they are not too near the houses, lest they should accidentally catch fire, and the heat oblige the troops to abandon the works.

SECT.

SECT. III.

When the village happens to be situated in a plain, in front of an army, or opposite to one of the wings, and intended as a post that is to be maintained, should an engagement happen; all the ground between it and the army must be well levelled, and the ditches and hollow ways filled up, or at least good communications made a-crofs them. All the hedges and brush-wood must at the same time be cut down, and indeed every obstacle removed which might hinder the troops in the village being sustained with ease and expedition from the line. On the contrary, the enemy's approach must be rendered as difficult as possible; and for this reason, every thing which serves to conceal their march, such as hedges, thickets, woods, and even single trees, must be cut down

down within two feet of the ground, on that side of the village which lies next them, that they may be seen at a distance, and exposed to the fire of the artillery from the works, the moment they appear. If there is time enough, deep trenches ought to be cut across those roads by which the enemy must pass; and if trees are planted along the sides, they should all be cut down, and thrown into them. Trous-de-loup may be also dug, to prevent the enemy's advancing in line, and in close order; so that, at last, one may almost be assured their attempt will prove fruitless.

S E C T. IV.

As entrenchments proper to fortify villages can never be intirely regular, it is impossible to lay down rules for their figure, which the ground alone must determine to the man who knows how to form

form a right judgment of it. I shall only observe, that a cross-fire should, if possible, always be procured. The hedges round the gardens of the village are often disposed in such a manner, that, by throwing up earth against them, they may serve to form part of the entrenchment: In that case, the tops of the hedges must be cut off breast high, so as to open the view entirely. If there are any hollow-ways parallel to the post, and at a proper distance, a parapet may be raised behind them. Every advantage of this kind ought to be seized, and will readily present itself to the man of genius and application, after a very little experience.

Should, however, the situation be such, as to afford no natural advantages of this kind, or if the gardens are trifling, or too near the houses (which the enemy might

FIELD-FORTIFICATION. 129

might set on fire) the entrenchment must then be advanced a little. It is composed of large fleches, with a parapet twelve feet thick, constructed at certain distances; which being joined by lines, and well provided with artillery, renders the post very respectable. When there is time, the attack may be made still more difficult by palissades, chevaux-de-frise, abbatis, trous-de-loup, fougasses, &c. added to the weakest parts.

The church and church-yard should likewise, if possible, be fortified; for the more obstacles that are opposed to the enemy, the greater reason there is to hope they will be repulsed. As the army is supposed to be near, there is little danger of not being properly supported in the day of action; so that one should never think they do too much. The flanks of the entrenchment must be well covered;

K

but

but it is necessary to have the rear entirely open; for if the enemy, by sacrificing a number of men, should become masters of the post, it might prove very difficult to dislodge them, was the line carried quite round, particularly if they were disposed to make an obstinate defense.

The hedges between the village and the army should be all cut down, as before-mentioned, that any re-inforcement may have easy access, and that the enemy may never be able to conceal their approach, if they should attempt to advance farther. The annexed plate fully illustrates every thing I have mentioned above. The village is situated in the plain, in front of the army *a*, and about six hundred paces distant. The front of the entrenchment is composed of three fleches, *b*, *c*, *d*, joined by lines. The
flanks

Plate
35.

FIELD-FORTIFICATION. 131

flanks *e, f*, are also entrenched. Trous-de-loup *g*, are dug in front of the left flank *e*. The dyke *b*, crossing the marshy ground *i*, is cut in several different places *l*; and the wood *m* destroyed, to prevent the enemy's approaching under cover. As an attack seems most practicable on the right flank, where the ground is even, trees are laid in form of an abbatis *n*, within fire of the garison's small-arms. The lines are thrown up as much as possible behind the quickset-hedges *o*, which inclose the gardens; but it is necessary to advance them *p*, in order to keep clear of the village; in the rear of which, all the hedges, &c. are intirely destroyed, and every thing laid quite open, to make the communication with the army the more easy.

A very different method is followed in fortifying villages so distant from camp,

K 2

that

that the enemy may make themselves masters of them before they can be supported; for then they are entrenched intirely round: but if, on the contrary, fuch a post fhould be adjoining to one of the wings of the camp, the flank muft be principally attended to, and properly covered, the works carried farther on, and ftrongly defended, that the enemy may not have it in their power to turn them.

SECT. V.

Another method is made ufe of to fortify fuch a village, when it happens to be one of the quarters of cantonment of an army; for in that cafe, there cannot be fo many men to defend it: but if accidentally there fhould be fufficient, they muft entrench themfelves in the fame manner as mentioned above, and likewise
cover

FIELD-FORTIFICATION. 133

cover their rear with fleches, joined by lines, as in front.

If, on the other hand, the garison is not numerous enough to defend extensive works, what are absolutely necessary, and such as they are able to man, must be only attempted. The entrances into the village may be covered by very small works, or well barricaded. Fleches should be here and there thrown up, the fences of the gardens serving by way of communications,

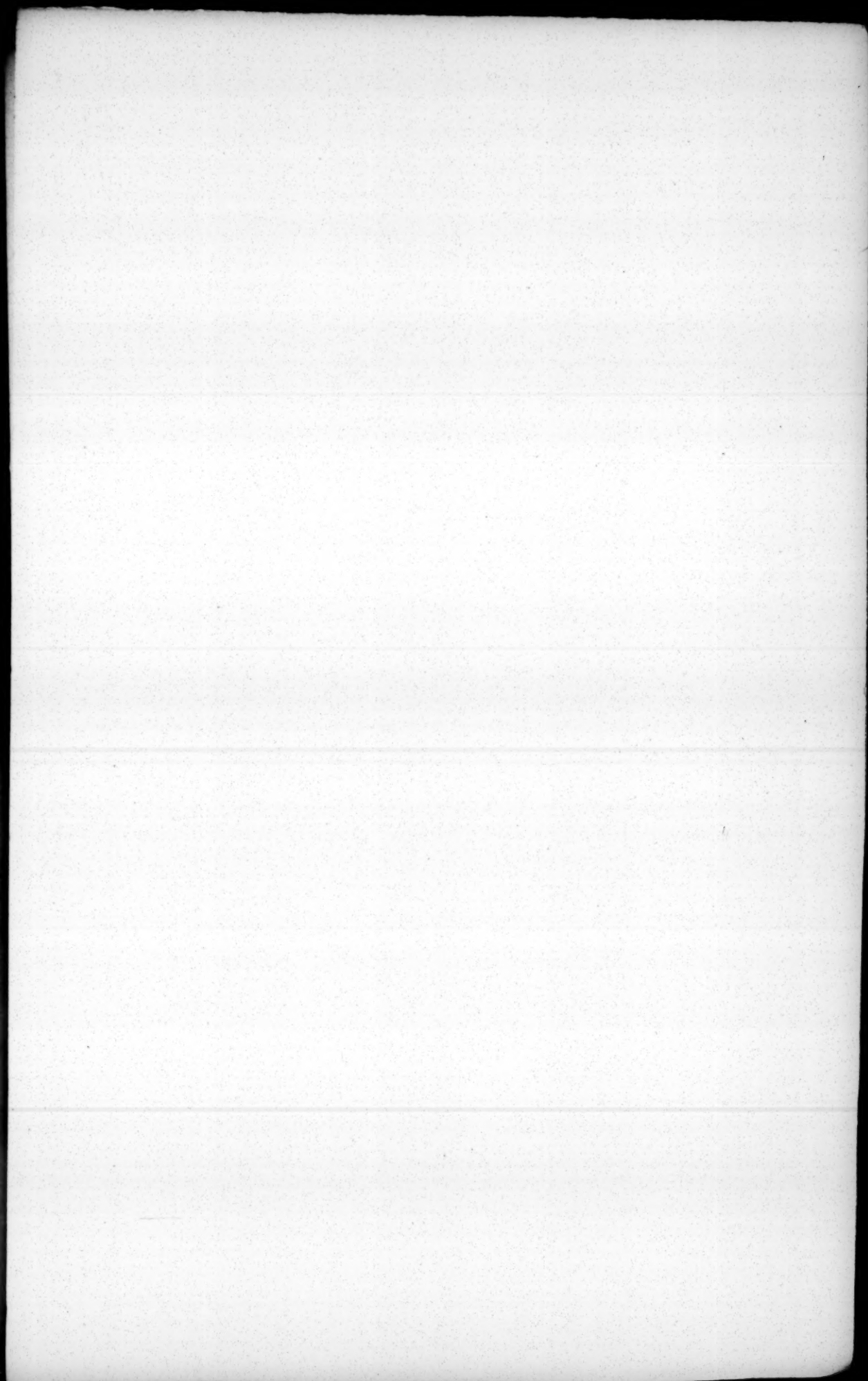
When the village is situated upon a height, it is fortified with much less trouble, as then the natural advantages render the post respectable ; and many things may be omitted, which cannot be dispensed with when it lies in a plain.

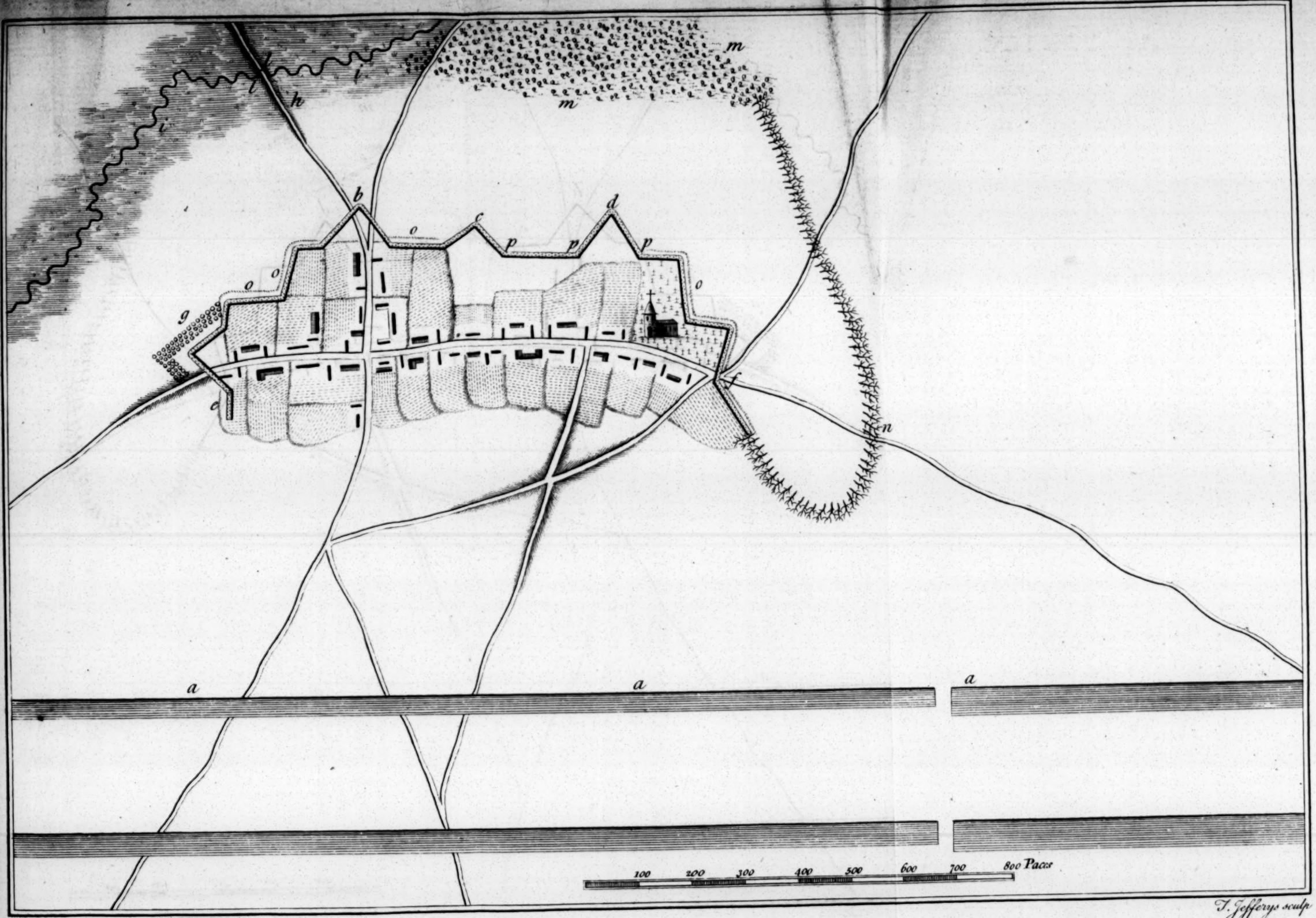
SECT. VI.

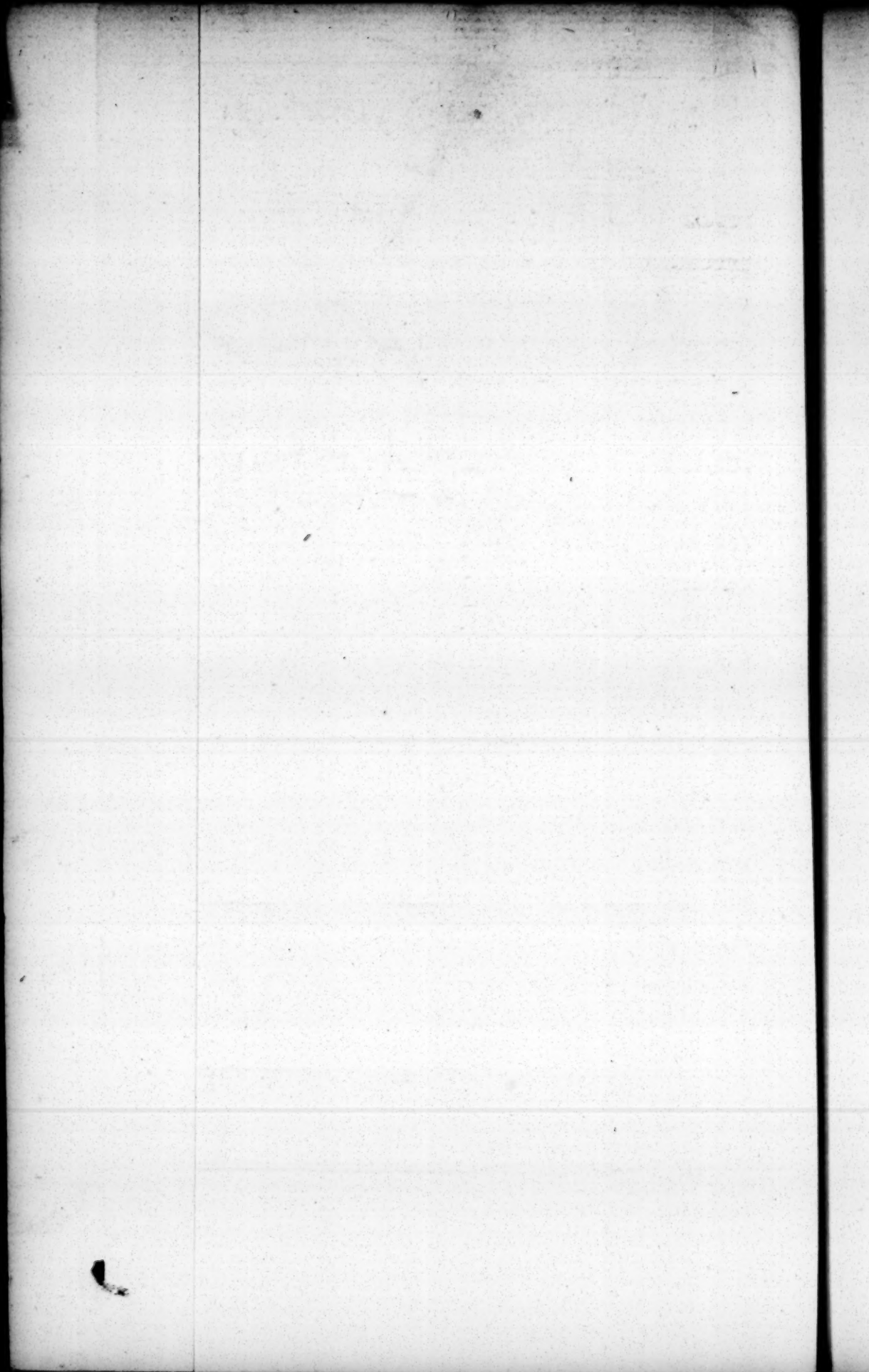
If there is no proportion between the extent of the village and the strength of the garison, the latter being too weak, only a part of it must be fortified, and a line thrown up, to separate it from the rest of the village. There is even sometimes a necessity for burning the houses that cannot be included, to prevent the enemy's establishing themselves in that quarter, and advancing under cover against the part that is entrenched.

SECT. VII.

But when the garison are not even strong enough to defend a part of the village, they should at least endeavour to fortify the church, church-yard, or old castle, if there is such convenient for
the







the purpose. Upon the first alarm, they repair to their post, having taken proper precautions not to be cut off by the enemy. This is doubly necessary in long straggling villages, which are frequently so very open, that even cavalry may pass wherever they please. All the ordinary roads and avenues must therefore be not only rendered totally impracticable, but the hedges thoroughly repaired, and the openings and gaps closed up, by driving in strong stakes, and nailing poles, or long pieces of wood, a-crofs. This will most effectually prevent any sudden surprise from the cavalry, which is only to be apprehended; for unless the garison are intirely off their guard, the infantry cannot easily come upon them unawares, and prevent their having time enough to gain their post. The most prudent way when an attack is expected, is, only to let the

men remain in their quarters in the day, keeping them assembled during the night, either in the entrenched post, or at least in the houses most contiguous to it, with strict orders not to undress.

SECT. VIII.

However, there are some villages it is absolutely impossible to defend, the houses being scattered about in long narrow vales, surrounded with high mountains and woods, as well as gorges and hollow-ways, by which the enemy cannot be prevented from penetrating. In such a case as this, the best disposition in the world will avail nothing; the post can never be defended. All, therefore, that can be done in situations of this kind, is, not to quarter the troops in those parts that are nearest the enemy, but in those
more

FIELD-FORTIFICATION. 137

more retired *b*, which must be separated from the rest of the village, by throwing up an entrenchment of earth *c*, at the same time barricading all the passages and avenues. A redout may be also constructed on a rising ground *d*, near the village, not being commanded by any other height, in which only the cannon, and a small guard, are constantly to remain; and on any alarm, this post is to be the place of rendezvous for the whole garison, which are for that reason to be regularly assembled every night in the houses next adjoining to the redout, especially when any attack is apprehended.

In order that those who quarter in the village may gain the redout with safety, a communication, four feet wide *e*, is made, with palissades planted on each side, running quite from where the men
assemble

assemble in the evening, to the redout. The palissades must be far enough asunder to allow firing between them with small-arms. When this communication is very long, a place of arms *f*, is made about the middle of it, in order to obtain a cross-fire.

SECT. IX.

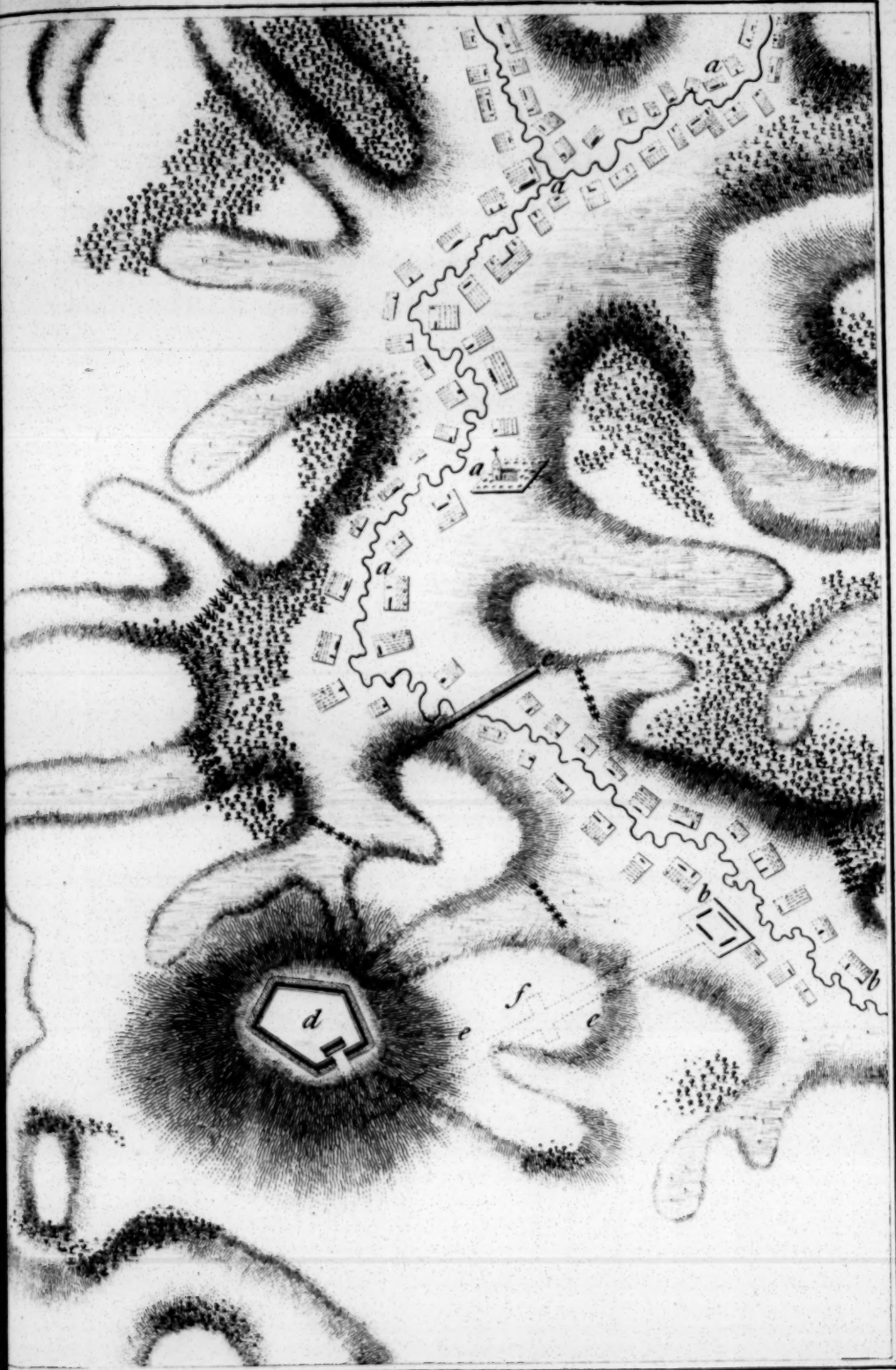
Indeed, one cannot be very easy in such a quarter; but it is absolutely necessary to know how to make the most of it. In general, the orders received must determine what defense is to be made; but if an officer is left intirely to himself, circumstances should regulate his conduct. If the village is only occupied by way of giving notice of what happens, to the other quarters more retired; or if only a few troops are placed in it to cover the
advanced

advanced posts of light troops against any small detachments of the enemy; the commanding officer will but ill discharge his duty, if, without hope of relief, he should take it into his head to defend himself to the very last extremity, against even a whole corps who had intirely surrounded him, and sacrifice his people to no purpose. He ought, however, to be very careful in examining the strength of whatever body of troops may be sent against him, and not trust to the report of every deserter, or those who are only patrolling carelessly from mere curiosity. He must, himself, see, and inspect, every thing. If, on the contrary, there are quarters of cantonment near at hand, from whence he may reasonably expect succours, he ought to maintain the post to the very last man, and risk the whole in order to save the whole. He must act in the same manner

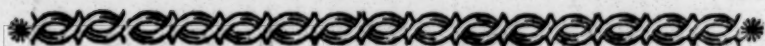
manner when his post defends a defilè, or any other pass; or when only sent to amuse, or stop, the enemy, to give time to the others that are farther back, to assemble. When this is the case, the enemy must never be supposed too strong, or the post occupied too weak.



CHAP.



2



C H A P. VII.

Scheme for fortifying a Town, or City.

THESE kinds of posts are likewise made defensible on different accounts; either for covering a magazine, or to keep up a communication with some place of more consequence; sometimes in order to defend a defilè, and dispute the passage, or to make it a winter-quarter, or cantonment. In short, whatever may be the reason, the proper arrangements in consequence of such a resolution, must be preceded by a strict examination into the following particulars: Whether it is probable that the enemy will immediately, or in a little time, make
any

any attempt: which side is the most easy for them to approach by: how soon any movement of the enemy can be known: in what time the post can be succoured: whether, if in danger of a surprise, or threatened with a sudden attack, a reinforcement could arrive in time: and whether it is expected to come from the camp, or the neighbouring quarters.

When positively ordered to defend a post to the very last extremity, the utmost attention becomes necessary; and in making the disposition against the attack, it is impossible to be too distinct or circumstantial. The lying of the ground near it, the situation of the place itself, with the state of the walls and buildings, must determine in this case, as in all others of the same nature, how the post should be fortified. However, what has been before said upon this subject, must be

FIELD-FORTIFICATION. 143

be exactly observed; at the same time, when the town is ordered to be maintained, cost what it will, the following memorandums ought to be attended to.

SECT. I.

The magistrates are required to give in an exact account of the number of inhabitants, and what provisions are in the place. If any of the citizens should be suspected of holding a secret correspondence with the enemy, they must be immediately turned out: but if in an enemy's country, and where of course the inhabitants are in general suspected, all their arms must be taken from them, and they strictly forbidden, under pain of death, to be seen in the streets, in case of an alarm in the night: they are to remain

main quiet in their houses, with the doors shut, and candles in their windows.

SECT. II.

As much of the provision found in the town as the garison can subsist on for a few days, must be collected, and carefully laid up in any church, old castle, or stone building, not exposed to fire, which is immediately put into a state of defense. This little magazine must not be touched, till the enemy have either blocked up, or closely attacked the place, and no other provision can enter. If the town cannot furnish such a quantity, the environs must be diligently searched. This is a most necessary precaution; for sometimes the garison are obliged to wait several days for a supply. In the mean time, something should be provided to subsist on, that they may not be forced, through

through hunger, to accept any conditions the enemy please.

S E C T. III.

When the place is situated in a plain, the walls in good condition, and not in any manner commanded by heights, the following disposition must be made, to defend it properly.

All the gates on that side next the enemy, must be strongly barricaded with large beams, and chests or casks filled with earth or stones placed behind them. If neither of these can be procured, dung may be thrown up as high as possible against the gates, within-side. Strong palissades are planted on the out-side, and a ditch, pointed at bottom, made to defend the approach, with large intire trees laid all along the front, the branches being well entangled. When all these precautions

cautions are taken, it is very improbable the enemy should attempt to penetrate this way.

On the other hand, one or two of the gates leading to the army, must be kept open: by way of communication, however, there ought to be a sufficient quantity of materials lying ready to barricade them the moment the enemy approaches on that quarter. In order therefore to be able to do so, without danger of being in the mean time forced, the gates should be covered by fleches, or tambours, with only an opening left wide enough for a carriage to pass. The entrances into the tambours must be farther secured, either with loop-holed gates, or with barriers made in the form of chevaux-de-frise, fastened by means of a pad-lock, and which may be raised and lowered at pleasure.

If

If any canals enter the town under the walls, they must be shut up with iron grates, and centinels posted near them.

SECT. IV.

When the gates are thus sufficiently secured, the walls are next to be put into a proper state of defense, by repairing them where broken down or decayed, either with masonry, or large beams. If the time will allow, scaffolding should be erected within-side, quite round; but if this cannot be done, it must at least be placed on each side of the gates, where it is most essentially necessary, as well as at the angles, and other weak parts. At these places a double row of loop-holes should likewise be pierced, six inches wide without, and twenty within, that several men may fire through together. They are three feet and an half high on

the out-side, and two feet and an half within, sloping a little outwards at bottom, that the enemy may be discovered when even close to the wall. The towers, and every part that projects, within the circuit of the wall, must have a double, and, if possible, a treble row of loop-holes, to furnish a cross-fire : when, on the contrary, a wall is not high enough, banquettes may be only thrown up, as mentioned in regard to the walls of church-yards.

A chain of centinels must be posted on the scaffolding, both night and day, quite round the wall. The cannon are placed at those parts most likely to be attacked ; and that they may be used with advantage, scaffolds, or large elevations of earth, should be raised on purpose for the artillery, or at least openings made
in

FIELD-FORTIFICATION. 149

in the wall, to serve as embrasures for them to fire through.

SECT. V.

If a stream runs near the town, dams must be laid a-crofs, to stop the current, and form an inundation. To prevent the enemy from using these dams as bridges, the passages must be obstructed by large branches, and even intire trees. This will likewise hinder them from cutting the dams, to drain off the water. At the same time, they should be so disposed, as to be defended from the wall with small-arms. Very great advantage is gained by this method ; for when the inundation is thoroughly compleated, all that side of the town is intirely secured from being attacked,

SECT. VI.

All the brush-wood, hedges, trees, &c. within musket-shot, must be cut down, to prevent the enemy concealing their approach. Even the suburbs must be burnt to the ground, in case the post is to be defended to the last. Some of the garison should be posted at the tops of the steeples, from whence the country all around may be more thoroughly commanded, to report every movement made by the enemy. At the same time, every possible intelligence should be procured by spies. Great fires must be kindled at the fall of the evening, about an hundred paces from the wall, and about two or three hundred paces distant from each other. They are kept up during the night by people particularly employed for that purpose (the inhabitants, for example),

FIELD-FORTIFICATION. 151

ple), and patrols are to be sent regularly, to prevent a surprise.

SECT. VII.

A rendezvous must be appointed, and every particular man made perfectly acquainted with his post, that he may repair there on the very first alarm; but when the enemy are near at hand, and their approach expected, the men must not be permitted to remain at their quarters in the night, but in those houses most contiguous to the rendezvous, constantly dressed and accoutred, that they may the sooner gain their post when the signal is made.

The weak part of the wall must have the largest proportion of troops assigned for its defense: a few will suffice where it is in good condition. The main-guard,

L 4

which,

which, as well as all other posts, is reinforced on an alarm, forms the reserve.

SECT. VIII.

To fortify and defend such a place properly, every circumstance must be thoroughly weighed and examined, as well as the orders which have been received. If the garison must hold out to the very last extremity, all possible means must be used not to be forced. The officer who commands, is supposed to be able to distinguish easily the false, from the true attack ; he will give himself little concern about the first, but endeavour to receive the latter with resolution and conduct. If the enemy should attempt forcing one of the gates, and batter it with their cannon, in order to make an assault ; as soon as their design is perceived, a breast-work must be
thrown

thrown up within-side, opposite to the gate, at about twenty or thirty paces distant from it. It may be constructed with large pieces of wood piled one upon another, carts loaded with dung, &c. The cannon placed behind this work must be loaded with grape-shot, and pointed at the gate, ready to fire upon the enemy, should they attempt to storm when the breach is completed.

Whatever part of the wall the enemy direct their attack against, they will endeavour to succeed either by escalade, or battering in-breach. The first must be prevented by placing before-hand several large beams, or logs of wood, upon the top of the wall, and tumbling them upon those who mount the ladders, when they are no longer to be repulsed by firing through the loop-holes. In order to render their other design of entering by the
breach

breach ineffectual, it must be immediately filled up with logs and large branches, which are instantly to be set on fire, as mentioned before in the defense of a church-yard, and plenty of fuel must be constantly supplied. A breast-work may likewise be constructed behind the breach, if materials can be got; and a sufficient body of troops posted, ready to receive the enemy when they attempt to enter. Soldiers should also be placed in the middle and upper stories of all the houses which command the breach. If the enemy should luckily be repulsed, the breach must be barricaded without loss of time, or continued to be filled up with logs and branches, setting them immediately on fire. But when it is perceived, that even all this will not in the end be sufficient to keep out the enemy, a retreat must be resolved on; which is at last effected by retiring to the church, or
what-

whatever building the provisions are lodged in, as it is supposed to have been previously put into a proper state of defense. Those not immediately engaged, first take possession of this new post, and are followed by the troops which defend the breach, who nevertheless leave a few tirailleurs * behind, to fire upon the enemy, and cover their retreat. In such a critical situation as this, it will appear at first sight of what infinite importance it must be, to have the principal streets leading to the church, or other post that is to be defended, barricaded with logs of wood, or simply with carts filled with dung. These retrenchments should have small openings left in them, sufficient for two or three men to pass a-breast, and

* Skirmishers or marks-men advanced in front to annoy the enemy and draw off their attention, or left behind to amuse and stop their progress in the pursuit.

should

should be occupied by a few soldiers only, to cover the retreat of the rest.

When things are come to this pass, the conduct of the commanding officer must be regulated by times and circumstances, the state of provisions and ammunition, loss already sustained, probability of receiving speedy succours, or the contrary : but, above all, by the orders he has received. These rules are not laid down as absolute, or such as cannot be departed from without the loss of honour and reputation ; they are rather to be considered as the ideas that will naturally occur, when it becomes necessary to make a desperate defense, which can only be on two occasions ; namely, when the conditions proposed by the enemy are scandalous and dishonourable, or when positively ordered to defend the post to the very

very last extremity: — orders which are only given in the sad necessity of being obliged to sacrifice an handful of men, in in order to save a whole corps.

S E C T. IX.

When the town to be defended is without walls, only furrounded with gardens, all the pains in the world must be entirely in vain; the post can never be made defensible. The only thing to be done, is, to construct fleches quite round it, at certain distances, mutually flanking each other. Instead of courtaings, trees are placed in form of an abbatis. Such a post, however, can only prevent a surprize, but is of no manner of use against a formal attack with cannon, &c.

S E C T. X.

When a place of this kind happens to be commanded by any height within
mus-

musket-shot, the most judicious measures that can be taken for fortifying it, will signify nothing: the best thing to be done, is, to construct a redout on one of the neighbouring heights, which the garison should occupy when the enemy approach, as mentioned before in the case of a long straggling village, situated in a narrow vale between mountains.





C H A P. VIII.

Method of forming Inundations.

THE advantages derived from stopping the current of brooks, and over-flowing the meadows on each side, have been before taken notice of. By this means fords are rendered impassable, and all the posts within a certain distance so well covered, that an attack upon them becomes impracticable. Inundations of this sort are formed by laying dams a-cross brooks, or streams, as follows.

S E C T.

SECT. I.

Plate 37,
Fig. 1. If the brook runs through flat ground, the banks being nearly on a level with the rest, dykes *a, b*, are raised on each side, at right-angles with the stream, about thirty or forty paces long, five feet broad, and the same in height. The upper side, or that towards the source, is lined with fascines; but it is unnecessary to fascine the other. If there is only three or four feet depth of water, a dam six or eight feet broad must be then formed entirely of fascines, in the middle between the two dykes, by laying one bed of them upon another, each being fastened with stakes, or loaded with stones, to prevent the current from carrying them away. But when the water is deeper, two rows of strong stakes, or piles, four or five inches diameter, must be driven close to each

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each other, between the two dykes. The two rows *c, d*, being eight feet asunder, will form a space *e*, called the coffre, which is then to be filled with earth and stones.

The course of the water being by this means stopt, it will naturally over-flow its banks, and being kept up by the dykes *a* and *b*, must consequently inundate the low grounds *f*, and seek new passages *g, h*, at the extremities of the dykes.

SECT. II.

If the brook is so very trifling, as to make it be apprehended that the inundation would not be of sufficient depth, small ditches *i*, four feet deep, and eight feet broad, may be here and there dug in the ground intended to be overflowed. This must be done before the

M

coffre

coffre is compleated. The earth taken out of them, is scattered about on each side. These ditches are naturally filled with water, as soon as the brook begins to over-flow its banks ; so that if the inundation should prove too shallow, the enemy will nevertheless find equal difficulty in passing it, as the little ditches can neither be perceived nor avoided.

To prevent the dykes serving by way of passages to the enemy, chevaux-de-frise, trees, branches, &c. are laid all along them. If the brook is rapid, the dam a-crofs it must be ten feet broad, or more, otherwise it will very soon be destroyed. At the same time it must be remembered, to lay it over at the shallowest place, which consequently will save a great deal of labour.

SECT.

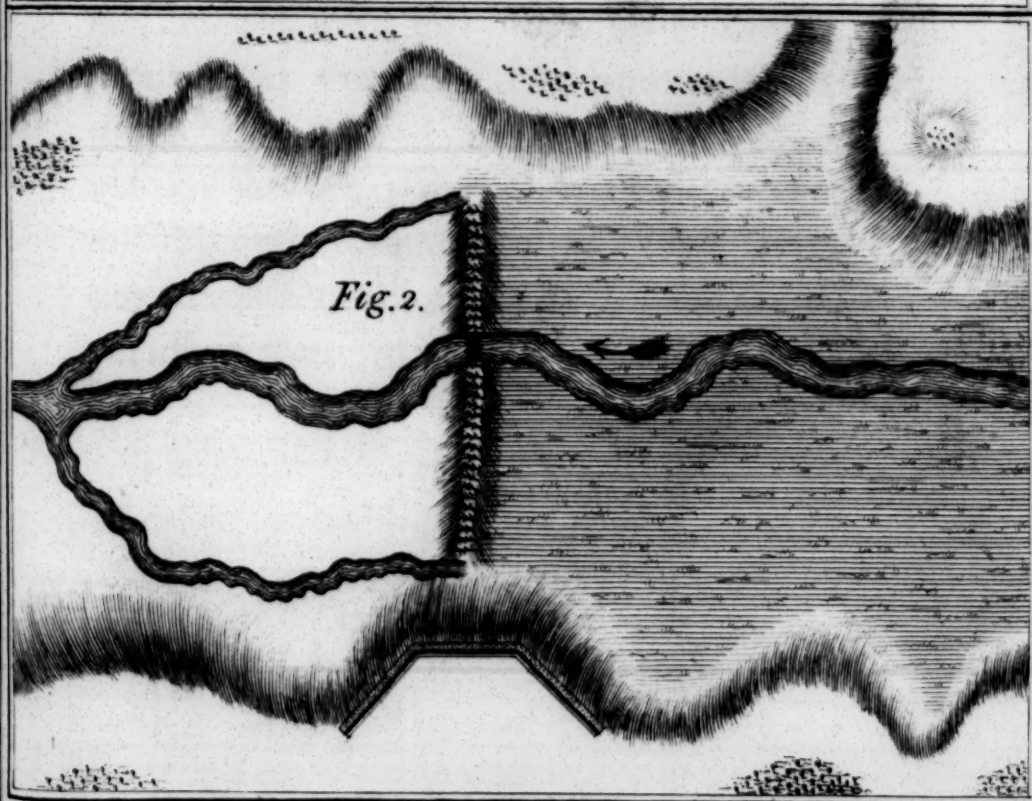
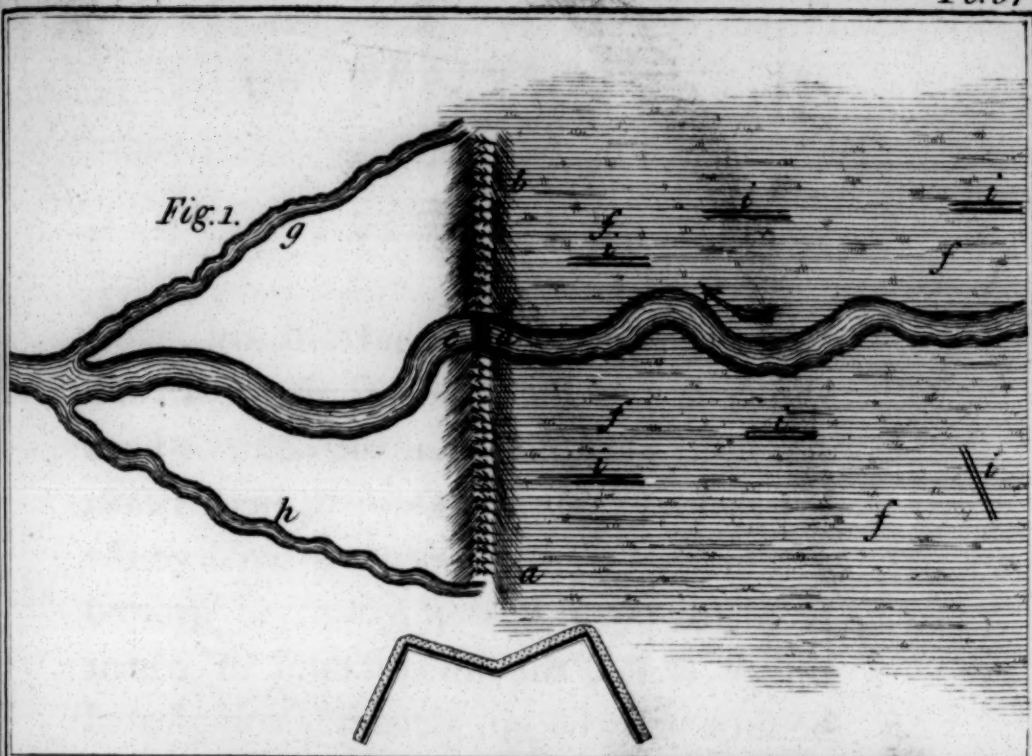
SECT. III.

When the stream runs in a narrow ^{Fig. 2.} vale, with heights on each side, the same kind of dykes must be raised, as above-mentioned; but to render the inundation deeper, they should cross the whole valley, leaving only a small opening at each extremity, that the water may pass, and not be forced to over-flow the dykes, which would very soon totally ruin them. These two openings must be lined with fascines, to resist this new course of the stream, and the dykes likewise made more sloping at those parts; otherwise the continual running of the water would wash them away by degrees.

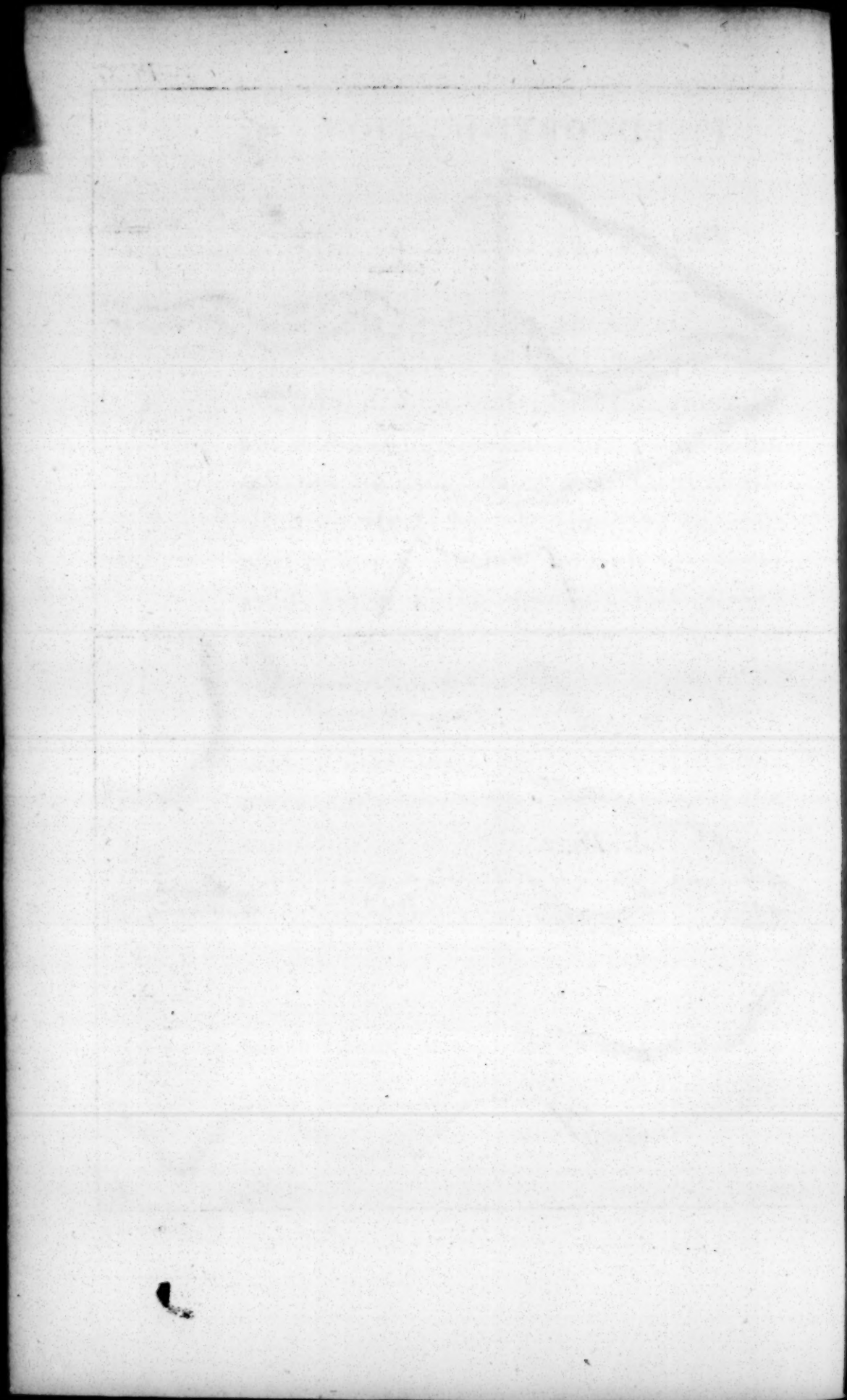
SECT IV.

When there is a pond already made, which is supplied by a constant stream, and sluices established in the dam, or head which keeps up the water : if, in this case, it should become necessary to enlarge the pond, or lay a greater extent of ground under water, the sluices must of course be shut 'till the inundation is compleated (if the height of the head is sufficient for that purpose), and are then to be opened just so much as to allow the quantity of water to pass, which the stream constantly supplies. Should this be neglected, the water would soon overflow the top of the dam, and gradually wear it away.

SECT.



2



S E C T. V.

By this means, part of a work, or indeed any post situated near a river, may be easily secured ; but it will occasion much more pains and labour to cover the whole front of a camp with an inundation, as not only several dams must be made, at certain distances, a-cross the brook, but likewise dykes raised over the low ground on each side. The quickness of the current must determine the distance at which these works are executed : if very rapid, they must be raised at every hundred paces : but when smooth and gentle, they may be farther removed from each other.

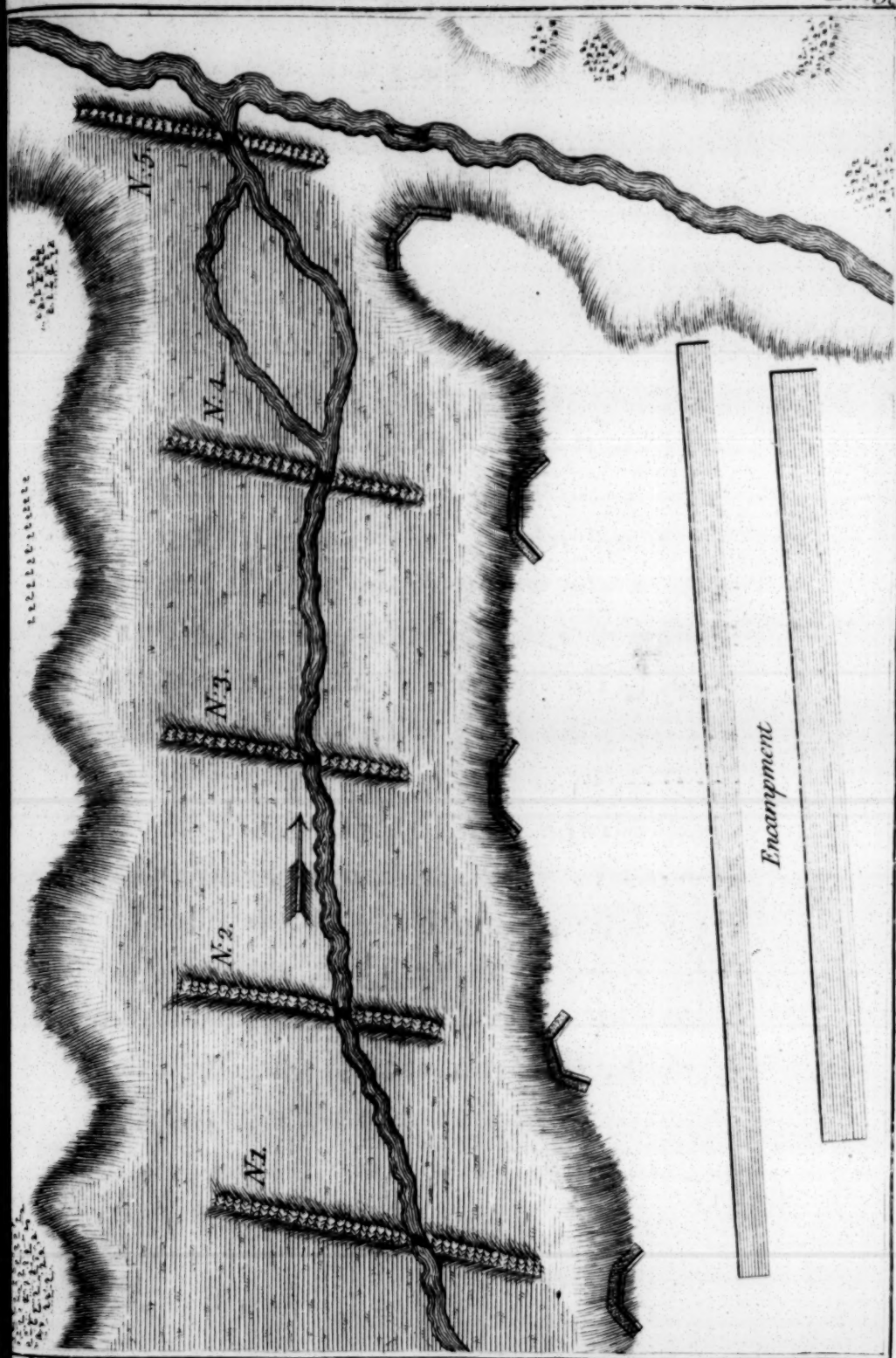
The space between two parallel dykes is called a coffre. This work must be always begun towards the head of the

M 3

stream,

stream, and so continued downwards,
Plate
38. which is fully explained in the plate, being properly numbered in the order they are constructed. If the contrary was attempted, for instance, to begin at the mouth of the stream, and proceed upwards, it is evident, that the work would soon be interrupted, because, after having made the first dyke, the flowing back of the water would prevent the possibility of carrying on the second; and so with the others. In short, these coffres must be filled with water, one after another, in the order in which the stream runs, till the whole front of the camp is covered by the inundation. The dykes are rendered impassable by chevaux-de-frise, trees, branches, &c. and also defended by some small works thrown up of earth, that the enemy may have no opportunity of passing them in the night, or cutting them to let off the water.

C H A P.



CHAP. IX.

Of the Construction of Fougasses.

IN order to render a work stronger, and more respectable, small mines, called fougasses, are constructed before the weakest parts, and generally those most exposed to an attack; namely, the salient angles, and faces, not defended by a cross-fire. Very little time is required for the construction of these mines, which are nevertheless of great utility: for suppose the enemy should have already advanced within a few paces of a work, yet they are not in the smallest degree nearer becoming masters of it;

M 4 since,

since, on springing the mines, they are blown up in a moment, which, besides the loss of men, throws the others into the utmost confusion, not suspecting in the least what is prepared for them.

As engineers may not always be upon the spot, it is therefore necessary that an officer of foot should know how to construct these mines ; for though he is not expected to be master of the whole art of mining, which would lead him into a detail both extensive and intricate, yet he ought to inform himself well in every thing relating to the construction of fougasses, with respect to which the following rules are sufficient.

S E C T. I.

At the distance of ten, twelve, or even fourteen feet from the ditch of a work,
a pit,

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a pit, or shaft, three feet square, is dug, to the depth of six, seven, or eight feet. When the earth is not of a very firm nature, the sides are supported with boards, or planks (in the same manner as practised in metallic mines), three feet long, having a small piece about an inch broad sawed out at each end, and half the width of the plank. When two feet of earth is dug out, four of these boards being put together, form a kind of frame, which is applied to the inside of the pit, just below the surface of the ground; and so on, as it becomes deeper, to prevent the earth from falling in. If it is a light sandy soil, these frames must be placed close together; but if not, about a foot interval may be left between them. Indeed in a clay, all this trouble may be saved, as no more supporting is required except the first frame almost even with the surface, that the workmen standing
on

Plate

39.

Fig.

1.

Fig.

2.

on the edge, may not break down the earth.

SECT. II.

When the shaft is of sufficient depth, properly supported, &c. a square hole is made at the bottom, in that side next the work, forming a lodgment for the box of powder. This excavation is called the chamber of the mine. It is also propped up with boards, or pieces of wood. The dimensions of the box holding the powder, fix the height and breadth of the chamber; but to save the trouble of measuring, it should be exactly a cube, whose side is one sixth part the depth of the shaft. If the latter, for instance, is six feet deep, the chamber must be a cube of one foot; and so in proportion.

SECT.

S E C T. III.

To know the proper quantity of powder for a mine, the depth must be known, and the nature of the soil thoroughly examined. The depth of an ordinary mine is six, seven, or eight feet ; but the following table of M. Vauban will determine at once the necessary quantity of powder proportioned to the nature of the soil.

T A B L E.

TABLE.

Depth of the Mine.	Ordinary Ground.		Sandy Ground.		Mixed Ground.		Clay.		Stony Ground.	
	Pounds.	Half-ounces.	Pounds.	Half-ounces.	Pounds.	Half-ounces.	Pounds.	Half-ounces.	Pounds.	Half-ounces.
A mine of 6 feet deep requires	14	25	17	28	18	31	20	—	23	4
7 feet - - - - -	22	5	26	8	26	11	27	14	31	20
8 feet - - - - -	34	13	42	6	44	10	46	13	52	18
9 feet - - - - -	55	18	67	16	71	20	75	26	88	—
10 feet - - - - -	78	18	96	4	100	20	106	8	121	28
11 feet - - - - -	104	24	125	22	132	24	139	26	163	—
12 feet - - - - -	132	20	161	4	170	24	180	8	208	28

SECT.

SECT. IV.

The size of the box is determined by the quantity of powder it is to contain : but there is a rule for that also, viz. the inside of the box must be a cube, whose side is exactly the ninth part of the depth of the shaft. Should the latter, for example, be six feet, or seventy-two inches deep, the inside of the box must be eight inches square every way. The cover is not made fast to it. A hole, an inch and half square, is cut in the side of the box, about an inch from the bottom, to admit a small wooden tube. The use of it is to conduct the fire to the powder. It appears about an inch on the out-side, but reaches quite to the middle of the box within, that the powder may kindle from the center, which produces the best effect. If there is reason to imagine the powder will remain long in the chamber of the mine

Fig.
3.

mine before it is fired, it will be necessary, particularly in a moist soil, or where there are springs, to pitch well over all the joints of the box, or line it with straw, woven together, and wrapt up either in straw, wax-cloth, or mats, to keep the powder from contracting any damp. When want of time, or other circumstances, makes it impossible to procure such a box, some other contrivance must be thought of; for instance, a bucket, a corn cribble, a small basket, in short, any thing of this kind will do, provided the wooden tube above-mentioned can be applied. When the box is filled with powder, and the cover laid upon it, it is placed in the chamber of the mine, which must fit it exactly, without projecting into the shaft. Great care must be taken, at the same time, that it does not move in the chamber; for if the latter should be either too high or too wide, the vacant
space

space must be filled up with sod, or pieces of wood. A board three feet long is then placed before the box, so that it is intirely shut up in the chamber: but a hole, three inches square, is first cut out at the bottom of the plank, for the small wooden tube to pass through.

Fig.
4.

SECT. V.

The mine is fired with a fauciffon, which is a long pipe in form of a faufage, made of coarse cloth, or fustian, sewed length-wise, about two inches diameter. As it must be well crammed, near half a pound of powder is allowed to every foot. This train reaches from the chamber to the place within the redout where it is fired, called the foyer *, or focus. The

* The author calls the end of the fauciffon that comes within the work, and which is to be set fire to, the foyer or focus; but in mines, this is generally understood to be the center of the chamber. However, the term is preserved in the translation.

fau-

fauciflon, to preserve it from growing damp, is laid in an auget, or long wooden trough, made of boards three inches and an half broad, joined together lengthwise. A part of the auget, two feet shorter than the shaft is deep, is then placed perpendicularly in it, in such a manner, that the lower end communicates with the small wooden tube fixed in the box of powder. It is sometimes nailed to the frames supporting the sides of the shaft. A small channel, two feet deep, is next made from the pit to the ditch of the work, and the auget laid along in it, nailed to the part set upright. From thence it is continued a-cross the ditch quite to the rampart, which it likewise passes, an opening being cut for that purpose, as far as the focus *a*. The lower end of the fauciflon is then tied with a piece of pack-thread to the above-mentioned wooden tube, which communicates

Fig.
5.

Fig.
6.

cates with the powder, and is laid all along the auget, quite to the focus within the work, fastening it to the sides, every half foot, with small iron-nails, driven with a wooden hammer. The lid of the auget is then made fast with wooden nails, and the channel cut for it filled up, as well as the rampart repaired. Where the auget crosses the ditch, it must be supported with two or three pickets *b*, driven well into the ground, and to which it is nailed. Some stones are laid over the end of the auget within-side the work, as it is there on a level with the ground, and liable to be moved; or it may be secured with some cross-pickets, driven in obliquely.

In this manner one may proceed when straitened for time; but when that is not the case, the auget, instead of crossing the ditch, should pass underneath it, so as

N that

Fig 7. that it may be every where two feet below the surface. If the ground happens to be moist, or that there is reason to think the mine will not soon be sprung, the joints of the auget should be well pitched within. But, on the contrary, when the soil is dry, there is no occasion at all for an auget; some dry straw wrapped round the faucillon, about four or five inches thick, will be perfectly sufficient.

SECT. VI.

When every thing in regard to the auget and faucillon is quite compleated, three or four pieces of wood, about three inches thick, and three feet two inches long, are put against the board which is placed before the box of powder, and two such pieces against the upright part of the auget. The shaft is then solidly filled up with earth.

Four

Fig. 1.



Fig. 2.

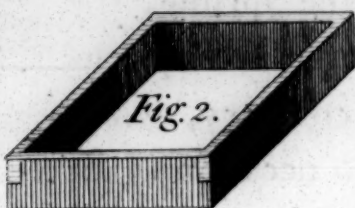


Fig. 3.



Fig. 4.



Fig. 5.

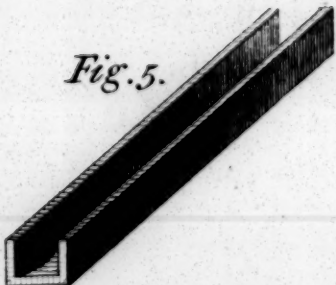


Fig. 6.



Fig. 7.



DECLARATION

I, the undersigned, do hereby declare that the foregoing is a true and correct copy of the original as the same appears in the records of the Court of the County of [] State of []

Witness my hand and seal this [] day of [] 19[]

Notary Public for the State of []

FIELD-FORTIFICATION. 179

Four workmen provided with pick-axes, and two carpenters, may easily construct such a fougasse in six or seven hours, if they are furnished with all the necessary materials.

SECT. VII.

The focus where the mine is fired, must be eight or nine paces from the rampart, and great care taken that it neither catches fire accidentally, not gets injured by damp. The end of the auget at the focus, must be about six inches longer than the faucisson, to preserve the latter from rain. Six inches of the cover are therefore cut off, and only laid on loosely, that it may be removed when the mine is to be sprung. Some bruised, or ordinary powder should be in readiness when the enemy begin their attack, to strew over the focus and end of the faucisson (first removing the small piece of the cover), and a match applied the moment the enemy are arrived upon the spot over the mine.

SECT. VIII.

When a mine is well constructed, and properly charged, the instant it is fired it forms an excavation called the entonnoir, or funnel, resembling an inverted cone, or sugar-loaf, the diameter of which at top is exactly twice the depth of the shaft. For example, if the pit is six feet deep, the diameter of the funnel will be twelve feet; and if ten feet deep, the diameter will be twenty feet, and so in proportion.

Plate
40.
Fig.
1, 2.

SECT. IX.

Sometimes several fougasses are constructed in front of a work; but then it is not necessary that each should have a particular focus, as one may be quite sufficient for three, four, or even more mines. If they must go off one after another, an
auget

FIELD-FORTIFICATION. 181

auget must be laid from each, two feet below the surface, within two feet of the ditch, almost meeting in a point, from whence they are continued separately across the ditch and rampart, running very near each other, quite to the focus. It must only be remembered to make the augets of different lengths, that the mines may be sprung separately; and to be careful that the fire, when put to one, does not communicate with the others. By having only one focus to several mines, a great deal of trouble is saved, as otherwise the rampart must be as often cut through, as there are augets to conduct. Fig.
3.

SECT. X.

But when several mines are intended to be sprung at once, a point, some feet from the ditch, must be found, equally distant from all the different chambers. An auget, with a fauciflon, is then laid from Plate
40.
Fig.
4.

from each to this point, the ends joined, and a single auget and fauciffon continued a-crofs the ditch and rampart to the focus; fo that of courfe all the mines muft go off at the fame instant, as foon as the match is applied to the focus. Care, however, muft be taken, to have the fhafts fo far afunder, that the effect of one does not interfere with that of another; or, in other words, that the funnels formed by the explofion do not crofs. This is intirely prevented, by making them double their depth afunder.

SECT. XI.

Fig. 5. Thefe kind of mines may be conftituted and very advantageoufly difpofed *entrefle*, or in a triangular form, before the falliant angles of works. That they may be fired together, a point is found equally diftant from the three chambers, called the center of the chambers. An auget, with a fau-

FIELD-FORTIFICATION. 183

a fauciflon, is then laid from each mine to this point, and from thence a single auger is carried over the ditch, &c.

SECT. XII.

If circumstances should make it necessary to abandon a redout, or any other work of that kind, (though newly raised) which might be of advantage to the enemy if left undestroyed, mines are constructed under the rampart, that it may be blown up the moment the last of the troops have quitted it. Or in the case of a tete-de-pont that is to be thrown up to cover the retreat of a corps, and which, from the first, is intended merely as a temporary work ; before it is begun, shafts should be sunk from five to seven feet deep, directly under where the rampart, and principally its angles, are to come, that it may be destroyed when the rear-guard

guard have passed the river. To find what quantity of powder such mines will require, the height of the rampart must be added to the depth of the shaft: for example, if the latter is five feet deep, and the rampart six feet high, a charge is allowed for a mine eleven feet deep. The focus of these mines is always in the center of the work, and the fauciflon laid in an auget.



THE END.

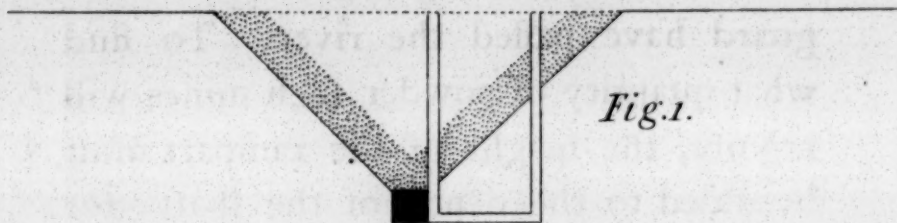
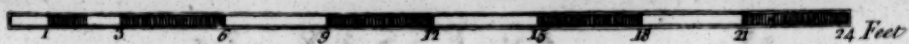


Fig. 1.

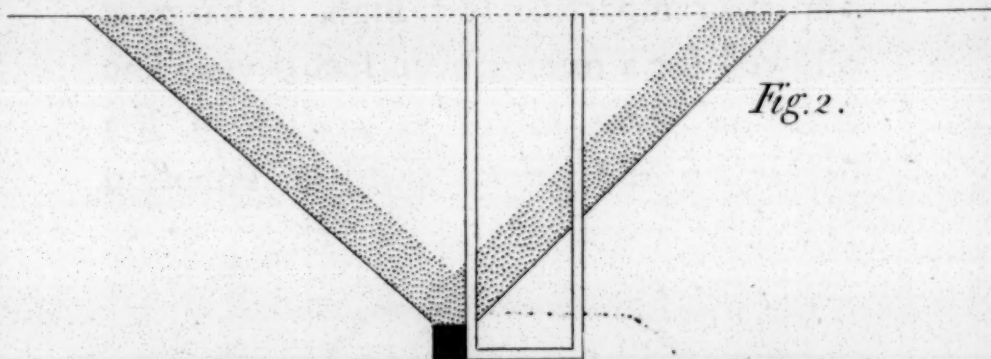


Fig. 2.

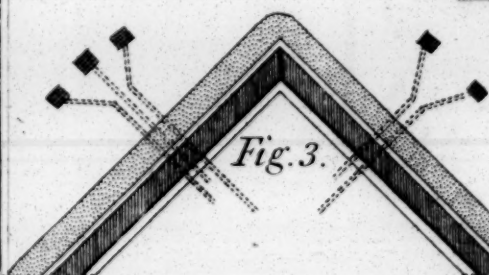


Fig. 3.



Fig. 4.

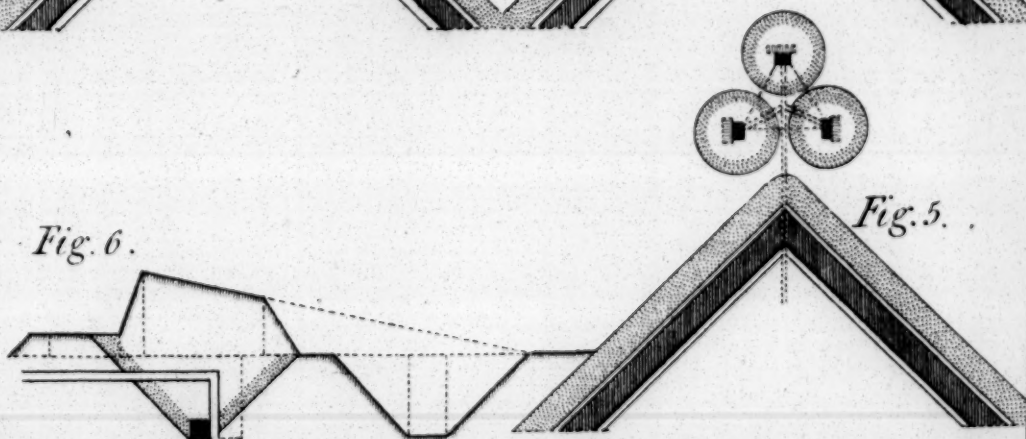


Fig. 5.

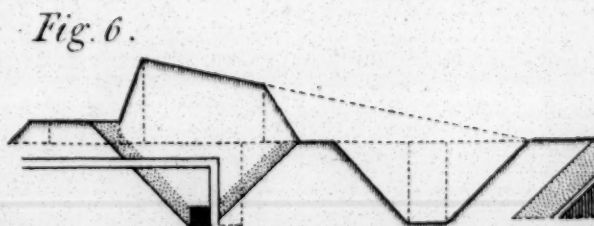


Fig. 6.

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